

2.

Field Notes on the Lizards
of Kartabo, British Guiana, and Caripito, Venezuela.
Part 3. Teiidae, Amphisbaenidae and Scincidae.¹

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(Plates I-V, Text-figures 1-16).

[This contribution is a result of various expeditions of the Department of Tropical Research of the New York Zoological Society to British Guiana and to Venezuela, all made under the direction of Dr. William Beebe. The Guiana expeditions were made during the years 1909, 1916, 1917, 1919, 1920, 1921, 1922, 1924 and 1926, and the Venezuelan trips in 1908 and 1942. The latter was sponsored by grants from the Committee for Inter-American Artistic and Intellectual Relations and from four trustees of the Zoological Society, George C. Clark, Childs Frick, Laurance S. Rockefeller and Herbert L. Satterlee, and by invaluable assistance from the Standard Oil Companies of New Jersey and Venezuela.]

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INTRODUCTION.

This is a third paper on the lizards of Kartabo, British Guiana, and Caripito, Venezuela.² In the year 1909, and from 1916 to 1926, eight expeditions went out from this department to British Guiana, and in 1908 and again in 1942 field work was carried on in Venezuela.

Throughout the course of these expeditions many field notes, color plates and

photographs were made of tropical vertebrates, and the object of this present series of papers is to assemble and publish these notes and illustrative material. Any change or alteration of the original notes is placed between brackets. The chief value of these data is that they are concerned with living or recently killed specimens.

The observations in Guiana were made in one-quarter of a square mile of jungle at Kartabo, and those in Venezuela at or close to Caripito, which is only 528 kilometers northwest of Kartabo.

In addition to numerous technical papers in *Zoologica* and several popular volumes, there have been published the following general ecological summaries: *Zoologica*: (Kartabo) Vol. II, No. 7, 1919, pp. 205-227; Vol. VI, No. 1, 1925, pp. 1-193; (Caripito) Vol. XXVIII, No. 9, 1943, pp. 53-59. Also see "Tropical Wild Life in British Guiana" by Beebe, Hartley and Howes, published by the New York Zoological Society, 1917, pp. 1-504.

My hearty thanks go to Dr. Charles M. Bogert of the American Museum of Natural History and Dr. Karl P. Schmidt of the Chicago Natural History Museum for identifications and for bringing up to date my out-worn names of many years ago.

My original field numbers and other data have been appended to descriptions, breeding and other notes. These specimens are either in the collections of the Department of Tropical Research or in those of the American Museum of Natural History. Whenever the term total length is used, a perfect unregenerated tail is understood. Many of the figures in the plates are black and white reproductions of original color paintings, so only the pattern is preserved. The following plate figures are from

¹ Contribution No. 705, Department of Tropical Research, New York Zoological Society.

² Part 1, Gekkonidae, *Zoologica*, Vol. 29; pp. 145-160; Part 2, Iguanidae, Vol. 29, pp. 195-216.

paintings by Isabel Cooper, Figures 1, 3, 4, 5, 6, 7, 8, 12, 13, 14, 15 and 16. Figures 9, 10 and 11 are photographs by John Tee-Van. Text-figures 4, 5 and 6 are by Isabel Cooper; 1, 2, 8, 10 and 13 by Helen Tee-Van; 3, 7, 9, 11, 12, 15 and 16 by George Swanson.

FAMILY TEIIDAE.

Ecology of the Genera: Of the family Teiidae ten genera and twelve species were taken. Only one of the species was lacking at Kartabo while six were not captured during our relatively short stay at Caripito. No one of these genera is numerically dominant as is *Anolis* among the Iguanidae. In fact, all but two are monospecific as far as our collections go.

Ameiva is widely distributed over Central and South America in few species but many subspecific forms. A dozen species of *Bachia* are found over much of north and central South America. We found *B. cophias* at Kartabo, replaced by *B. heteropa* at Caripito. *Cnemidophorus* has differentiated into only three or four species, while *Iphisa* is monospecific and confined to northeastern South America. Two out of about eight species of *Kentropyx* were found at Kartabo, the genus occurring over northern and central South America, while *Neusticurus* with a similar distribution, contains six or seven species. Three species of *Leposoma* extend from Central America south to Brazil, one being found by us. The single species of *Tretioscincus* occurred both at Kartabo and at Caripito and one of the four species of *Tupinambis* which range over much of the continent.

Occurrence: In order of relative numbers as observed by us, we have: abundant, *Cnemidophorus*, *Ameiva*; common, *Kentropyx*, *Leposoma*, *Tupinambis*; occasional, *Bachia*, *Neusticurus*, *Tretioscincus*; rare, *Euspondylus*, *Iphisa*.

Size: From small to large; *Leposoma* (average adult 90 mm.), *Bachia* (123 mm.), *Iphisa* (127 mm.), *Tretioscincus* (130 mm.), *Euspondylus* (166 mm.), *Kentropyx* (200 mm.), *Neusticurus* (207 mm.), *Cnemidophorus* (225 mm.), *Ameiva* (377 mm.), *Tupinambis* (760 mm.).

Food: All the lizards of this family are carnivorous, the food ranging from minute insects in the case of *Bachia* and *Leposoma* to good-sized birds and mammals which are caught and devoured by *Tupinambis*. Tadpoles and small fish form the food of the swimming *Neusticurus*.

Sexual Dimorphism: This is strongly marked in only two genera, *Ameiva* and *Cnemidophorus*, the females being noticeably smaller than the males (85 and 75 per cent. respectively), and breeding males,

especially in *Cnemidophorus*, are decidedly more brilliant. Female patterns and colors are rather persistently juvenile.

Eggs: The number of eggs which we recorded is as follows: *Bachia* 1; *Cnemidophorus* 2; *Leposoma* 2; *Ameiva* 2 to 4; *Kentropyx* 4; *Tupinambis* 4 to 12.

Habitat: Unlike the family Iguanidae the members of the Teiidae are terrestrial, *Tupinambis* alone showing arboreal ability, while *Neusticurus* is dominantly aquatic. *Bachia* and *Leposoma* are nocturnal and sub-surface in haunts. The former is often found in the nests of *Atta* ants, while *Tupinambis* breeds in termite nests. *Ameiva* and *Cnemidophorus* live in open, sandy areas, while *Kentropyx* and *Tretioscincus* prefer the floor of the jungle.

Enemies: The more common types of danger to these ground lizards are snakes, hawks and kites, while among more unusual enemies are coati-mundis, weasels and attacks by army ants.

Escape Methods: The two most usual methods of avoiding death are swift flight to the openings of prepared burrows and, in extremis, the relinquishing of tails to the assault of beak and claw. In this family quick adaptive color change and resultant trust to escape by immobility is almost unknown, compared with its dominance in the Iguanidae.

Ameiva ameiva ameiva (Linnaeus, 1758).

(Plate I, Figs. 1, 2 and 3).

Names: *Ameiva*. Mato. Why-lo-reek; Why-mat-sah (Akawai Indian, "one who lives on the ground").

Range: Central and Northeastern South America.

General Account: *Ameivas* are abundant and wide-spread in all suitable localities. This is essentially a terrestrial jungle lizard, but whenever available it prefers ground among rather open undergrowth reached here and there by direct sunlight. It is also found in numbers in open clearings, both natural as caused by some great fallen tree, or artificially cleared by Indians.

More than terrestrial, *Ameiva* is fossorial, living in a deep burrow, to the entrance of which it always rushes when threatened by danger. It occasionally falls into our jungle pits, but if left more than a day or two will burrow out of sight and even drive a tunnel obliquely up to the surface. Not rarely we find it inhabiting old pits when we return the following year, in this case having provided itself with two escape tunnels leading to some upper outlet well hidden beneath jungle underbrush. *Ameivas* seem to breed throughout the year, and deposit from two to four eggs.

Progression in Search of Food: If we

stand perfectly still in the jungle any ameiva in the vicinity soon loses its momentary fear and continues its search for food. It may approach and actually creep over one's shoe with no hint of reaction to any human odor. Every movement is a quick, short, sudden rush or jerk, and the lizard sometimes pushes out of sight beneath loose, fallen leaves. A very common movement is to fling or scratch back the leaves, with first one, then the other fore foot, like a hen, also recalling the similar but ineffectual motions of *Cnemidophorus*. It touches every leaf with its tongue, snake-like, whether or not there is anything edible on it. When creeping over my shoe I have seen two such tongue touchings with no hint that the substance was not a leaf or bark instead of canvas or leather. In progressing, these lizards almost never lift the body clear off the ground, but slide over and around everything, pushing themselves along with all four feet. When motionless, perhaps curious or suspicious, the tip of the tail is vibrated, another compensatory movement for the nervous hand waving of *Cnemidophorus*.

The above note was made on April 20, 1924. On July 6, eighteen years later, I wrote the following at Caripito:

Watched a good-size ameiva (in the color pattern of about 350 mm.) feeding in the short grass of the laboratory compound. It was fifty feet away but the number 20 binoculars brought it within arm's length.

Its head constantly dipped and dipped in a succession of jerks, the tongue forking out each time, the head swinging from side to side, two or three dips to the right and the same to the left, the animal at the same time taking two creeping steps ahead. No wagging of the fore limbs, but constant digging, as a hen scratches, with first one leg, then the other, the head being pushed sometimes almost its length down into the roots of the short Bermuda grass-roots. When a bit of food was sensed, the whole back was strongly arched—the weight being sustained wholly by the hind feet. The forepart of the body thus swinging free enabled the fore legs and feet to work rapidly in turn, neither of them resting on the ground—a pose realistically like that of a restored dinosaur. It would almost seem as if the tongue conveyed knowledge by scent as well as touch, for it often played close to but not touching the object nearest it, and sight had nothing to do with unearthing a grub or cocoon hidden an inch or two beneath the dense sod.

Size: Twenty adult males with original, perfect tails average 401 mm. in total length, while the same number of females average 354 mm. The largest male measured

was 535 mm. and the largest female 465 mm.

Femoral Pores: The total average of femoral pores in 46 individuals shows no difference in males and females. The general average is 21 pores with extremes of 20.8 and 21.4. Age has nothing to do with the number in spite of the fact that of those I measured the largest male (535 mm.) had the smallest number, 18 and 19 pores, and the smallest male (132 mm.) possessed the largest number of pores, 24 on each leg.

Generalized Ontogenetic Sequence of Pattern and Color: In lizards with head and body of 50 mm. or less (total length ca. 150 mm.) the color above is greenish anteriorly and brownish elsewhere. Along the upper sides is a broad black band from eye to thigh, bordered usually by white above and below. The lower sides are vaguely marbled and mottled with paler colors. The ventral surfaces are dark brown except for cream or salmon color around vent and under thighs.

In specimens of 70 to 90 mm. body length (total ca. 175 to 300 mm.), brown often appears on the fore part of the head, the green being more or less restricted to the mid-back or rump. The black bands possess a single central line of pale dots, or these may show an increase in number and tend to a vertical arrangement into lines. The lower lateral mottling changes gradually to dots and enlarged spots, and also inclines to vertical bands. The ventral surfaces shift slowly to pale green and blue.

In ameivas of 125 to 165 mm. body length (total ca. 350 to 530 mm.), the whole anterior half of the lizard to mid-back is brownish or red-brown including head, fore body and fore legs, and freckled or blotched with black. The posterior half of the creature is generally green, with the tail occasionally blue. The lateral black band has disappeared, its place being taken by a green or brown background, crossed vertically by numerous bands of round, back-framed, yellow or blue spots. Pale greens and blues characterize the ventral surface.

No definite notes were made on sexual differences in pattern and coloration, except that the development of both characters was ontogenetically delayed in the females. Female specimens with the black band still intact were seen of much larger size than in any male. Conversely, the ventro-dorsal encroachment of blue and yellow, black-framed, lateral spots occur in much younger males than in females. Yet full-grown lizards of both sexes more than 500 mm. in total length, with head and body length of 165 mm., were recorded, which in pigment and pattern were indistinguishable. For example, a female in full breeding

condition with eggs three-fourths developed was in earliest juvenile pattern and color. The dorsal surface was chiefly brown, very faintly olive green on the head, the lateral black band showing only a row of minute pale dots and a lower border of the same color; the ventral surface pale buff, the only bright color being a tinge of turquoise on the anterior part of the thighs. Yet this lizard had a body length of 125 mm. and a total length of 397 mm.

As hints of pigmental variation of the above generalizations, I reproduce two from among many detailed descriptions of individual ameivas. Both are males, the first in the juvenile pattern with body of 75 mm. and the second fully adult, 140 mm. from snout to vent.

Specimen No. 182: Dorsally the head is yellow olive green, the mid-back between shoulders the same, merging posteriorly into golden brown on the rump. The tail is raw umber with a few black spots. Face pale cinnamon buff. The black lateral stripe extends down the tail as a series of black spots, which show faint vertical lines of pale buff spots. The sides are yellow behind the shoulders, cinnamon farther back with hints of blue spots. Ventrally the chin is white, throat gray and breast yellowish-pink. The belly greenish-yellow, the vent zinc orange, and this color on the under tail shades into greenish-gray. The fore legs are golden brown beneath, umber above; the thighs and hind legs zinc orange with pale blue spots in front.

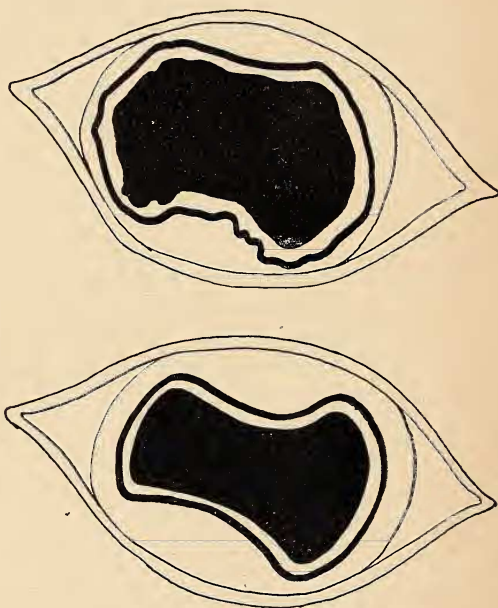
Specimen No. 184a: The head is dark raw umber, and the mid-back mahogany red merges into green on the lower back. Here the color changes to yellow green and into methyl green on the tail. The lateral band has become very indistinct, the original black persisting only as narrow frames around the vertical blue and yellow spots. The chin is white while the throat is dotted with dark spots. These are absent in this specimen from the head and neck. The breast is greenish-yellow shading to salmon and the belly is the same with a few blue spots along the upper edge. Vent apricot orange.

Tail Regeneration: As in many other species *Ameiva ameiva* sheds its tail very readily when an enemy attacks and seizes it. I once saw a lizard with three tails, and as many as four individuals with two. In two of the latter cases this was the result of a slight lateral injury from which a new tail had sprouted, this fact being deducible from the unchanged scalation and vertebration of one, presumably the original appendage.

In Specimen No. 180, 470 mm. over all, the head and body measured 145 mm. From the break, the original tail extended back

215 mm., while the additional tail was 125 mm. In Specimen No. 351, of 485 mm., a secondary tail only 7 mm. long had sprouted 55 mm. from the tip of the original one.

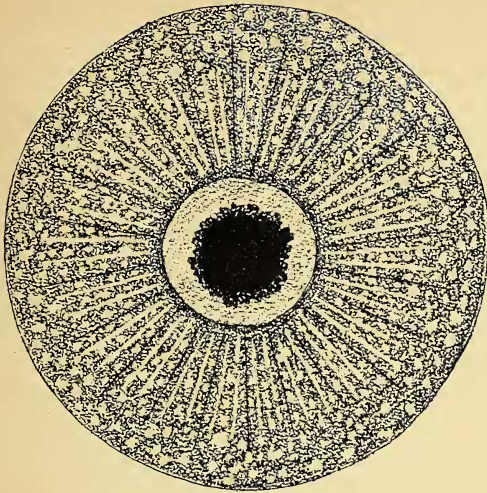
Iris and Pupil: A very distinctive character of ameivas of all ages and both sexes is the shape of the pupil, or perhaps more correctly, of the iris. The iris is golden, finely vermiculated with reddish and black flecks. In lizards of medium and large size there is a wide, conspicuous pupil frame of bright orange. What in most lizards would be a round pupil, in ameivas is deeply notched on the upper border and still more so on the lower rim, somewhat asymmetrally so that the general appearance of the figure is slightly oblique. The shape defies any exact name; it resembles a double, asymmetrical head of an ax as much as anything. Death causes no change in this shape. (Text-fig. 1).



TEXT-FIG. 1. *Ameiva ameiva*. Pupil outlines of two individuals, showing variation in shape. $\times 8$.

Fundus Oculi: Eyeground dark yellowish-gray covered with brilliant shining white dots, rather oblong in shape. The fundus is quite light toward the center owing to the many opaque nerve fibres. The optic disk is a rough circle with the pecten in the center but showing a broad band of the papilla around it. (Text-fig. 2).

The marsupium is conical, dark brown in color. The base where it runs down into the optic disk is a fine network of minute brownish-red veins. Also radiating from the disk alternately with the nerve fibres are brownish lines. These are about twice the



TEXT-FIG. 2. *Ameiva ameiva*. Fundus oculi.
× 15.

length of the opaque fibres and are quite pale where they run beside them, becoming darker beyond them.

The fundus oculi of *Cnemidophorus* and *Kentropyx* are indistinguishable from that of *Ameiva*.

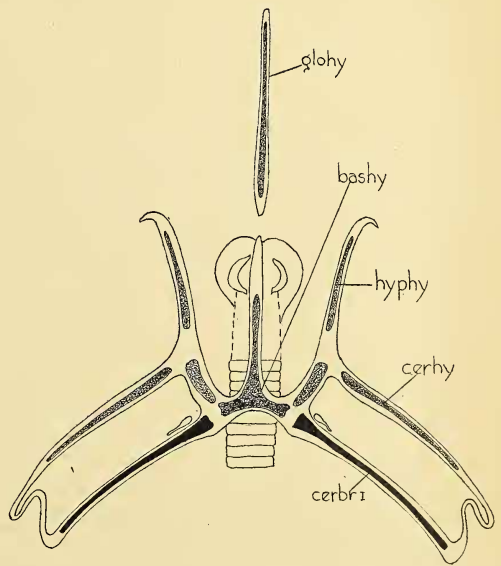
Hyoid: KOH. No. 2022, male, Kartabo, July 5, 1920. Text-fig. 3. The uro- or glossohyal is a long slender rod of dense cartilage, posteriorly branching into an inverted T-shape with short arms, each .7 mm. in length which represent the ankylosed basihyals. Anteriorly the median tongue element dies out in hyaline cartilage at a distance of 3.1 mm. and this in turn abruptly ceases after another .8 mm. There follows a very narrow hiatus, beyond which appears the continuation of the rod, a lingual process of dense cartilage which extends forward another 3.8 mm. The glottis appears just below the tip of the proximal portion of the glossohyal.

The proximal portion of the hyoid apparatus is attached firmly by cartilage to the slightly enlarged ends of the arms of the basihyals. First comes a short element, pointing obliquely forward, the hypohyal, 1.4 mm. in length, and extending beyond this a second element is directed almost straight forward to a distance of 4.2 mm. This I consider as still part of the hypohyal, making that element adaptively divided into two parts (like the similarly divided glossohyal). An identical although unseparated condition is shown in the hyoid of *Dracaena guianensis* as illustrated in Fig. 22, Plate 2, of Cope's "Crocodiles, Lizards and Snakes of North America."

At the junction of the proximal and distal elements of the hypohyal arises the posteriorly directed ceratohyal, 6.2 mm. in length.

From the junction of the basi- and hypohyals there projects backward, as a long rod, the ceratobranchial of the first branchial arch, 6.3 mm. long. These hyoid elements all have dense cores which fall short of the joints, and all are bound firmly together with hyaline cartilage. The tips of the long processes, one anterior and two posterior, terminate in rather short, curved hook-like ends. Alongside the very base of the ceratobranchial and exterior to it lies a small, narrow, free bit of cartilage with an enlarged, rounded head. Although this is quite buried in hyaline tissue and is only one millimeter in length, it may perhaps be the remains of the second ceratobranchial, an element which is much larger and in more typical position in the hyoid of *Cnemidophorus*.

The reticulated portion of the tongue begins about half way down the length of the glossohyal. At the posterior end of this latter element the tongue ceases and divides into two strong bands of muscle, which separate and pass over the curved and flattened basal element of the hypohyal and on down the channel between the ceratohyal and ceratobranchial, fitting comfortably between them. The anterior isolated lingual process lies embedded in the tissue of the tongue, ending behind exactly at the point of divergence. The glossohyal begins beneath the tongue, below the two bands of muscle which pass on either side and above it. A remarkable thing about the hyoid of this lizard is the complete union of the posterior ends of the ceratohyal and ceratobranchial, their tips being connected by a



TEXT-FIG. 3. *Ameiva ameiva*. Hyoid of adult.
× 4.3.

sinuous winding ribbon of cartilage, hardly softer than their own substance.

Food: The following list gives the detailed stomach contents of 25 Kartabo ameivas of assorted sizes, mostly more than 250 mm. in total length. (1) one three-inch orthoptera full of eggs; (2) small caterpillar, grasshopper, spider, 40 *Hemeticia* larvae; (3) woodroach, small snail; (4) two termites, two roaches, scorpion; (5) two beetles, ant, grasshopper; (6) two adult centipedes with 17-20 young; (7) grasshopper, dipterous larvae, small mantis, three mosquitoes; (8) two beetles, large grasshopper; (9) large grasshopper; (10) scorpion, millipede, earthworm, grasshopper, roach; (11) scorpion, two grasshoppers, spider; (12) scorpion, weevil, small quartz crystals; (13) caterpillar, spider, roach, orthoptera, quartz crystals; (14) two dipterans (*Cyclorhapha*); (15) centipede, hemipteron, beetle; (16) eleven centipedes, ant cocoons, roach, ten black ants, quartz crystals; (17) cricket, snail; (18) large grasshopper, roaches, beetles, insect eggs; remains of two butterflies; (19) roach, beetle, insect eggs; (20) taken from stomach of a boa, contained roach, winged ant; (21) workers and soldiers of *Syntermes* sp., two centipedes, millipede, cricket, roach, two beetles; (22) three scarabs, spider, lizard egg; (23) beetles, three roaches; (24) five beetles, roach, snail; (25) spider, winged ant, was killing a 70 mm. sphingid caterpillar when shot.

In Caripito, Venezuela, day after day I watched from the laboratory as ameivas large and small leaped into the air after low-flying *Catopsilias* and *Uranias*. The small lizards often leaped clear of the ground. Out of a great many attempts I saw four which were not wholly failures. Twice the butterflies were nipped, and one of these times it fell to the ground but escaped. On two occasions two small ameivas caught the lepidopterans squarely and devoured every part. This was the case with captive lizards which, both with ameivas and plicas, ate as many butterflies as I provided and fought with each other over a single insect. Wings were invariably eaten unless they fell to the ground, when they were left.

The food record of *Ameiva* can be summarized by a list of the chief ingredients of diet, arranged in order of frequency of occurrence: Roaches (18), beetles (16), grasshoppers (14), centipedes (9), spiders (8), scorpions (7), snails (4), millipedes (4), termites (4), mantids (3), caterpillars (3), diptera (3), dipterous larvae (2), crickets (2), and once each of the following: butterflies, earthworms, earwigs, hemiptera and wasps.

Enemies: *Xenodon severus* and the com-

mon boa are the worst serpent enemies of ameivas at Kartabo. In one of the latter I found remains of three lizards, and three other snakes of the same species had fed on these unfortunate lizards. Two *Xenodon* which I dissected had eaten ameivas, and at Caripito two full-grown ameivas were taken from the stomach of an eight-foot *Drymarchon corais corais*. I saw two species of hawks in the act of unsuccessful attacks, one of which secured and carried off the entire tail.

Parasites: The large male ameivas seem especially susceptible to attacks by external parasites. Several species of large ticks often fasten on various parts of the body and even near the mouth and eyes. The armpits and thighs are occasionally filled with solid masses of bête-rouge. Small tape-worms and nematodes occur in the stomach and intestines in greater numbers than in any other lizard I have examined.

Breeding: Breeding seems to be distributed throughout the year. The following dates represent eggs or females with eggs about to be deposited: March (2 records), May (2), June (3), July (3) and October (2).

On July 2, 1919, I took a female of 230 mm. in a burrow a foot underground, with two eggs. One was broken in the capture, the other was leathery in texture, ivory white, fine-grained, oblong, weighing one gram and measuring 10.4 by 10.4 mm. A female of 397 mm. shot October 13, 1920, contained three eggs almost fully developed but without shell. On the same date a second female of 469 mm. would have deposited four eggs within a day or two.

Bachia cophias (Schneider, 1801).

Names: Worm Lizard. The Kartabo Indians had no name for this lizard and were in mortal terror of its supposed ability to sting fatally.

Range: Northeastern South America.

General Account: These were found occasionally at Kartabo, and intensive search would probably change its numerical status to Common. It is essentially fossorial or sub-surface, and in the dry season we found them under jungle débris, in decayed logs, and as deep as 30 cm. when digging jungle pits. In three instances they were taken from the nests of attas. After the rains began, several were found in early morning crawling over wet leaves, and on four occasions they fell into our pits.

The mode of progression of *Bachia cophias* is interesting. When it moves ahead quietly, of its own accord, it makes constant use of its small mittened feet, especially the front pair which work frantically and are of real use in pushing the lizard along in

a straight line. The hind feet also move continually but the slight downward curve of the mid-tail is so strong a lever that the hind limbs are often lifted slightly into the air where they continue to labor violently and futilely. On level ground the body is sometimes slightly raised above the surface, and for a few steps the lizard becomes a real quadruped. The motions are quite saurian and not ophidian, being short, quick jerks. The tongue constantly flickers in and out. (Text-fig. 4).

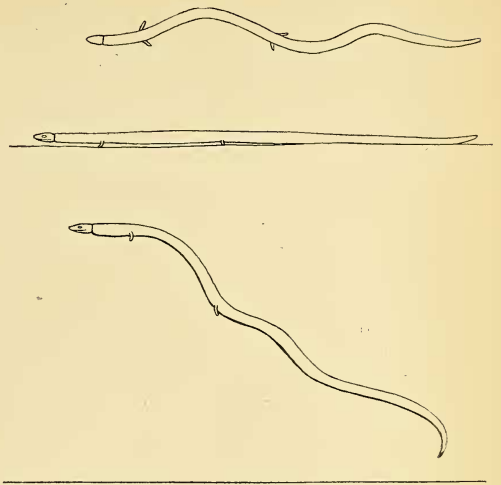
When touched or alarmed at the approach of a hand it often whirled the front half of its body about in a snake-like fashion and started off in a new direction, and in a wholly different method of progression. This was serpentine, the body moving in successive lateral waves, the legs dangling uselessly, moving in vain clear of the ground or occasionally rubbed into it. When thoroughly excited or in an extremity of alarm it leaped clear into the air by a sudden flexion of the posterior half of the tail, clearing at least three times its own length in height and advancing still more. The best leap, which I measured accurately, took it ten inches up and thirteen ahead. This action was so sudden and unexpected that it was startling enough to be a most efficient means of escape from an enemy. When the Indians saw this movement, it seemed to heighten their fear of the creature.

In water the lizard dived for a moment, then swam ashore with snake-like lateral undulations. Whenever it encountered bamboo leaves or loose débris of any kind, its first instinct was to creep or burrow beneath. Its sight seemed very poor in spite of its relatively good-sized eye, and two inches seemed the farthest distance of noticing anything in motion. When laid on a table for the first time it leaped over a four-inch partition into a pencil box and burrowed between the pencils. These observations were made on Specimen No. 3130, a male of 110 mm. taken July 10, 1919.

Measurements: Five specimens with uninjured tails show the following dimensional percentages:

| | | Total length | Head |
|-------|--------|--------------|------|
| 3131: | Male | 66.5 mm. | 7.5% |
| 2982: | Female | 90 | 5.7 |
| 3130: | Male | 110 | 5.5 |
| 2983: | Female | 116.5 | 5.2 |
| 332a: | Female | 135 | 4.5 |

In the three males, the head, body and limbs show relatively smaller percentages with increase in growth, while the tail increases. The two largest specimens are females and the weight of 1.25 grams in



TEXT-FIG. 4. *Bachia cophias*. Three methods of progression, undulation, walking and leaping. $\times .5$.

Specimen No. 332a includes an egg which was laid on the following day. (Text-fig. 5).

Color in Life: In general these diminutive lizards are dark red-brown above with four longitudinal lines and lateral mottling of light terra cotta, fading posteriorly to vinaceous pink. Below dull purplish-brown.

Eye: In all descriptions the eye is said to be minute, and in preserved specimens it appears very small. In life, however, it is surprisingly bright and conspicuous.

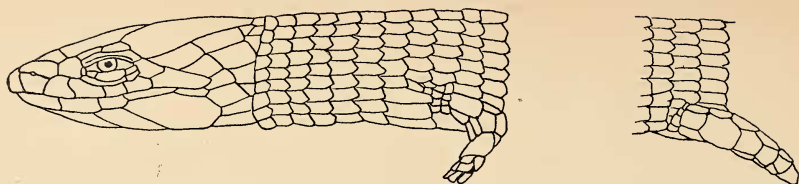
Food: In the stomach of No. 3130 was a small grub, many microlepidopteran scales and numerous fine particles of quartz. No. 3131 had eaten four ants and two sowbugs. A third *Bachia* had eaten two grubs and three termites.

Enemies: A perfect specimen, No. 604, measuring 150 mm. in total length, was taken from the stomach of a coati-mundi, *Nasua nasua*, shot in the jungle near Kartabo. The lizard in turn had made a meal on two small grubs and three termites.

Breeding: Specimen No. 332a, female, 135 mm. total length, taken in one of our

| Body | Percentages of Length | | | Weight |
|------|-----------------------|------|----------|--------|
| | Tail | Legs | | |
| 42.2 | 50.3 | 3 | .3 grams | |
| 39.3 | 55 | 2.7 | .8 | |
| 29.5 | 65 | 1.8 | .6 | |
| 38.9 | 55.9 | 2.3 | .8 | |
| 39.2 | 56.4 | 2.4 | 1.25 | |

jungle pits June 22, 1920, contained an egg about to be laid. It was in a median position in the body and so distended the skin that the hind legs were stretched clear of the ground and were quite useless even in slow



TEXT-FIG. 5. *Bachia cophias*. Side view of head and limbs. $\times 5$.

locomotion. The front legs pushed the body along while the posterior half of the lizard wriggled slowly. The egg was deposited on the following morning beneath a leaf. It was an elongated, parallel-sided oval, 4.1 by 11.5 mm. The shell was leathery with a calcareous roughened surface, showing slight, longitudinal striae. Faint transverse furrows divided the egg superficially into six segments.

Bachia heteropa (Lichtenstein, 1856).

Name: Fourteen-toed Worm Lizard.

Range: Venezuela.

General Account: At Caripito this was the only member we found of the genus *Bachia*. The most distinguishing character, aside from the color, was the number of degenerate toes. In *cophias* the number on fore and hind feet are three and one; in *heteropa* the corresponding numbers are four and three.

In life the two lizards were much alike in movement, habits and occurrence. The half dozen which we collected were taken while digging pits, or else fell into them after the rains, or were dug out of decayed logs. (Text-fig. 6).

Specimen No. 30012 was 165 mm. over all but, when taken in the hand, promptly lost half of its tail which expired after a period of frantic flicking about. Later, another section of ten segments parted company and although handicapped by its unbending,

stubby character, yet managed to roll around for a time. Progression by feet seemed somewhat more skilful than in the Kartabo species. A close superficial resemblance exists between this worm lizard and the young of a small species of burrowing snake, *Atractus trilineatus*. More than once in the dim light of the jungle we had to confirm the presence or absence of legs before we could be certain.

Color in Life: Chestnut brown above with a wide band down the back of dull cinnamon gray stippled with chestnut, fading into solid chestnut toward tail. A narrow stripe of chestnut down center of dorsal band. The band is edged on each side with a linear series of arrowheads of pale olive buff. Inner border of these marks edged with chestnut. The arrowheads get smaller and fade out entirely toward tail. Iris straw yellow.

Cnemidophorus lemniscatus lemniscatus

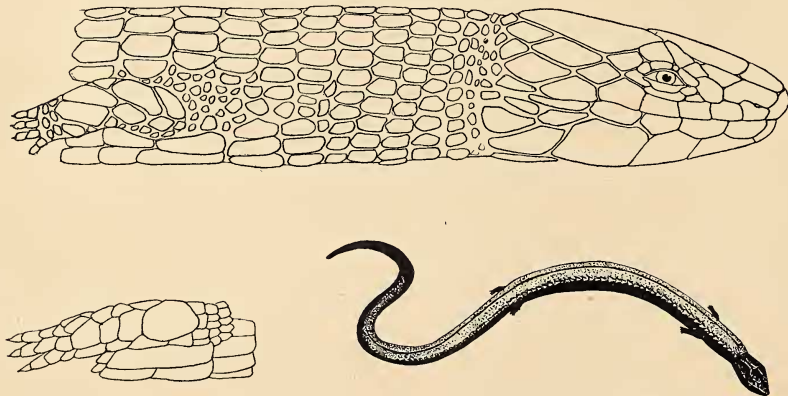
(Linnaeus, 1758).

(Plate II, Fig. 4)

Names: Striped Jungle Runner. Wyak-wyak (Akawai Indian, "One who lives on the ground").

Range: Northern South America, north into Central America and on some islands.

Field Characters: Brown and green lizards of medium size, the males larger and brighter. They can be identified as far as they can be seen by the eternal, nervous,



TEXT-FIG. 6. *Bachia heteropa*. Side view of head and limbs.

alternate, waving in midair of the fore legs.

General Account: This is the most common lizard at Kartabo, the young being more in evidence than those of any other species. It was even more abundant at Caripito, doubtless due to the open country and adjacency to the llanos. More were caught in Pit 13, which was dug at the edge of the llanos, than in all the jungle pits combined. The jungle runner is essentially terrestrial and lives in burrows which it excavates. It is by necessity a jungle lizard at Kartabo but only where the sunlight has access, especially clearings, trails and the shores of rivers. It climbs more frequently than *Ameiva* but only to low heights and for short periods.

Cnemidophorus is typical of those lizards whose whole life is controlled by sunlight. A cloud dims the sun and every one of the hundreds anywhere near seeks his hole or crevice. At the first hint of sunlight all come forth. I have seen one of these lizards creeping over the jungle leaves and could almost predict his course by the glints of sun which came through the foliage and lighted up the floor.

There is an interesting aural connection between these lizards and their relations the ameivas, and birds. Both birds and reptiles may be feeding quietly in a jungle clearing, the birds on insects and berries of the low undergrowth, the lizards scampering about or progressing by short, quick jerks, searching for food as they move. I may be sitting so quietly that I have avoided notice until some antbird or tanager spies me and sets up a piercing cry of alarm. I am not surprised to see every bird within sight or hearing take heed and fly off or at least perch quietly on the alert, but it is still more interesting to see the alarm understood by the lizards as well and every one rush headlong for his burrow. The reaction is as thorough and instantaneous as that between wild pheasants and mouse deer in the forests of the Himalayas.

More than other lizards *Cnemidophorus* in many ways reminds me of birds, especially in their nervous activity, their quick, short jerky movements and the way they have of looking quickly about. Then again, the larger individuals when running at full speed along a smooth, open stretch, often get up on their hind legs and sprint in a bird-like, bipedal position on their hind toes, the front legs and the tail held high off the ground.

The most characteristic thing about these lizards and the most inexplicable is the curious, nervous twitching or shaking of the fore legs. Very often they would escape observation were it not for this conspicuous

habit. First one, then the other fore leg is lifted, rapidly shaken or trembled and lowered to the ground again. This may occur when the lizard remains in one spot, or a shake may be given between each slow step. It has nothing to do with the alternate scratching or digging movements of *Ameiva*, and as far as I know, does not occur in any other genus of lizards.

In addition to feeding on the ground *Cnemidophorus* will now and then pursue an insect several feet up a low shrub. Not infrequently it will also leave the ground for another purpose. I have seen them a number of times flattened on the branch of some fallen tree, head, body and tail close to the bark, with all four legs lifted and spread out in mid-air. If we disregard the slender limbs, the general effect is of a short, green and brown snake asleep on the branch. The lizard is not asleep but it invariably chooses a spot in full sunlight and may lie there motionless for an hour at a time, or until the sun goes behind a cloud.

Fear, in these lizards, is developed in exact ratio to size. It is easy to creep up in full view of a small individual, to within three feet, but the larger the lizard the more distant the deadline which it sets for the approach of possible danger. Young lizards also recover from sudden fright sooner than their larger fellows. Seconds may mark the time of passing of suspicion in youngsters, while adults will remain motionless and on the alert for several minutes.

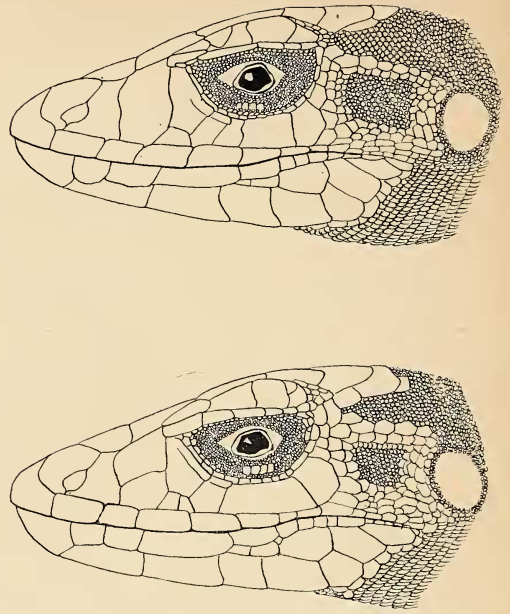
Detachment, loss and subsequent regeneration of the tail is as effective in *Cnemidophorus* as in other related lizards. Usually if shot, or if the creature is grasped awkwardly in the hand, the tail breaks off and if free, goes through a period of violent activity, wriggling about and snapping clear of the leaves, gradually weakening and, as far as appearances go, expiring. The curtailed owner, meanwhile, according to circumstances, either rushes to safety within its hole, or creeps quietly beneath a leaf or other protection. Again and again, when I had not seen the escape of the lizard I have grasped at the rustling disturbance to find only the nervous tail in my hand.

Three times I have seen in this species a peculiar semi-detached condition of the tail, with interesting effects lasting from several seconds to a full minute. When from a single dust shot or otherwise a lizard has been slightly wounded in the tail the motor control over that member is lost and although at my approach the lizard may wish to remain motionless, his tail has become a separate entity as regards activity, and wriggles about frantically, wholly regardless of the desires of its owner, sometimes actually knocking him over and tossing him

about. On two occasions with a violent twist the lizard managed to free himself from his unruly tail, and rushed off, probably more frightened than he had ever been. The tail continued to rustle and flop about, making a great racket among the dry leaves, and accomplishing its last duty, perhaps a more important one than it had ever fulfilled. On the third occasion the tail refused to desert its owner, or, more scientifically, the muscular attachment was too strong to be broken, and when last seen was giving a final wriggle, rather impeding the progress of the lizard as it fled down its hole.

An instance of a still slighter wound, but one sufficient to stir up reactions more appropriate to more serious conditions, is to be seen in Plate II, Fig. 4, where a diminutive new tail has sprouted from near the tip of the original tail of this female.

Size: As regards size, the females average about three-quarters as large as the males (measurements of 102 individuals, all with perfect tails, gave 73.5 per cent. The average of males were 260 mm. in total length; females 191 mm.) Different aspects of relative size were apparent when total lengths were compared of breeding versus non-breeding males and females. Breeding males are without exception the individuals of largest size, averaging 285 mm. as compared with 253 mm. of non-breeders. But non-breeding females averaged 202 mm., while females in full breeding condition showed an average of only 175 mm. total length. My breeding female *Cnemidophorus* at Kartabo were all taken in the long rainy season, May, June and July. If another brood of females of different age should come into breeding condition at the time of the short rainy season, this linear anomaly might be explained. (Text-fig. 7).



TEXT-FIG. 7. *Cnemidophorus lemniscatus*. Right and left side of the head of one individual, showing asymmetry of sculation. Spec. 30,284.

Weight: The weights of male lizards range from 2.2 grams for a youngster of 140 mm. (body length 43 mm.), to 19 grams for a breeding male of 290 mm. (body length 89 mm.). When a large number of males, all with perfect tails, are compared, their weights reveal several distinct nodes correlated with growth. A 150 mm. lizard weighed 2.4 grams; lizards from 205 to 230 mm. averaged 6.6 grams; those from 250 to 270 mm. averaged 12.1 grams, and the largest ones from 280 to 290 mm. showed an average weight of 17 grams. The curious

MEASUREMENTS, AS SHOWN BY PERCENTAGES OF TOTAL LENGTH.

| Cat. No. | 2972 | | 2986 | | 2956 | | 2968 | |
|---------------|------------|-------|-----------|-------|-----------|-------|-------------|-------|
| Sex | Male, juv. | | Male, br. | | Male, br. | | Female, br. | |
| Total Length | 148 | | 290 | | 280 | | 197 | |
| Head | 12.5 | 8.4% | 27 | 9.3% | 26 | 9.3% | 18 | 9.1% |
| Snout to Vent | 43 | 29% | 89 | 30.7% | 85 | 30.4% | 67 | 34.9% |
| Tail | 105 | 71% | 201 | 69.3% | 195 | 69.6% | 128 | 65.1% |
| Eye Diameter | 2 | 1.3% | 3.5 | 1.2% | 3.8 | 1.4% | 2.9 | 1.5% |
| Fore Limb | 17.5 | 11.8% | 33 | 11.4% | 33 | 11.8% | 28 | 14.2% |
| Hind Limb | 29 | 19.6% | 63 | 61.5% | 61.5 | 21.2% | 52.5 | 26.6% |

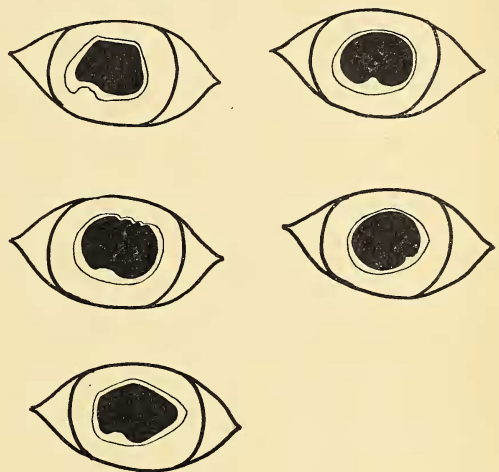
part of this was that there were almost no intermediates connecting the separate averages. In regard to the females, those in breeding condition (which as we have seen are less in size) far outweigh the larger non-breeding individuals. For example, twelve breeding females with an average length of 175 mm. averaged 8.4 grams, while an equal number of non-breeding females with an average of 213 mm. total length, weighed only 6.9 grams.

Color in Life: Any general description must disregard the maze of lesser details of variation which, when hundreds of individuals are examined, would require chapters of endless minutiae. In general the full-grown male *Cnemidophorus* have the top of the head cinnamon brown, the tip of nose and supraocular scales vivid green. The mid- and lower back are divided bilaterally by two longitudinal black bands, fading into cinnamon at the head and merging into the tail on each side. These bands are separated from each other by narrow lines of buff and divided down the center of the back by a broader but less distinct band which tends to divide into two lines on the mid-back. The tail is cinnamon brown with two chief black bands continuing some distance down it as a series of spots. A narrow edge of the ventral tail green is visible on each upper side. The face is emerald green shading into greenish-yellow with canary yellow spots on neck and behind the shoulders. The eyes are rimmed with bright yellow. Sides purplish-gray with bright greenish-yellow spots and single narrow line of greenish-yellow separating them from the black of the back. Chin, throat and breast pale vivid green. Lower surface grayish-white, turning into orange yellow at the sides just in front of the thighs. Vent maize yellow; limbs bright green in front, yellow beneath and neutral brown on top, the legs and thighs spotted with buff.

The head of the females is cinnamon brown, with the mid- and lower back divided by the black bands as in the male, but with five longitudinal bands on each side separated from each other by four narrow lines of buff. The three dorsal bands are black, the fourth and fifth lateral ones are golden brown and less distinct, as is the buff line separating them. Mid-back and upper tail as in male. Face is gray tinged with flesh color. The lower sides with two longitudinal stripes, golden brown behind shoulders. Chin and throat blue-gray, ventral surface maize yellow changing to greenish near the vent. Arms pale blue and greenish-gray beneath. Legs and thighs greenish-yellow thickly spotted with buff. Brownish below.

The coloration of young lizards is ac-

quired soon after hatching and remains unchanged in both sexes up to 80 to 130 mm. total length. The head and throat seal brown. The back with nine narrow, very distinct, longitudinal lines, creamy-white, separated by inter-spaces of black. The central dorsal light line, which is brownish, splits into two halfway down the back but posteriorly is lost at the tail base. The limbs are black dorsally, with numerous creamy-white dots and spots. There is an orange tinge on the sub-ocular and opercular region, absent in the very young. The under parts are clear green, becoming paler on the neck and chin, which are white in very young lizards. From the base of the hind leg a strong ivory white line extends back on the tail, with three fainter lines dorsally. (Text-fig. 8).



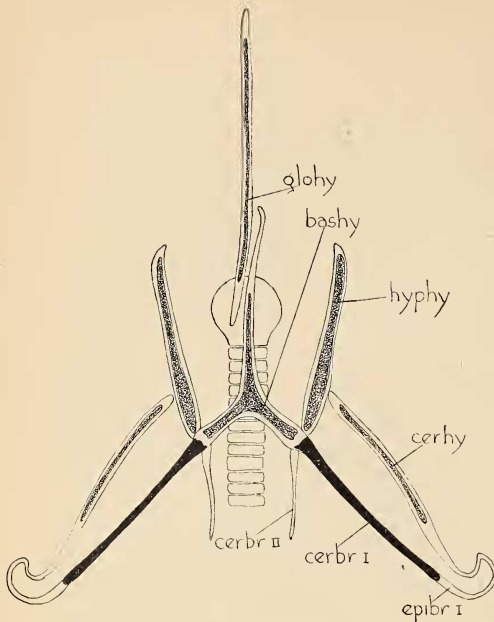
TEXT-FIG. 8. *Cnemidophorus lemniscatus*. Pupil outlines of the eyes of five individuals, showing variation in shape. $\times 4$.

The male *Cnemidophorus* of Caripito seemed generally to be much brighter and especially more blue than green. This may have been due to their occurrence in open country, in low and very open jungle, or actually in the llanos.

As in *Ameiva* the most significant ontogenetic pattern and color change in the present species is a gradual breaking down of the dull dorsal and especially lateral lines and bands into more or less brightly colored spots.

Femoral Pores: There is no appreciable difference in number of the femoral pores in male and female lizards, nor in age, the extremes being 21 and 20, and 27 and 25, on right and left legs respectively. Numerous counts show about one additional pore in breeding males and females over non-breeders regardless of size—scarcely a character of any significance.

Hypoid: KOH No. 2019, Kartabo, male,



TEXT-FIG. 9. *Cnemidophorus lemniscatus*.
Hyoid of adult. $\times 9$.

body length 65 mm., July 8, 1920. Text-fig. 9. The glossohyal extends forward as a slender rod to a distance of 3 mm. It diminishes in caliber anteriorly and half of its length is hyaline tissue, the cartilage core ceasing altogether. Anterior to this basal part is a detached segment, 4.5 mm. in length, with considerable clear tissue at both ends. With the tongue retracted as in the preserved KOH specimens, the two median ends of these glossohyal elements overlap almost half their length, but when the tongue is extended the termini lie end to end, forming a single glossohyal rod of 7.5 mm. This recalls a somewhat similar condition in the hyoid of *Ameiva*.

The proximal end of the tongue element separates into the basihyals, each arm being a single millimeter in length. From the tip of these basihyals we find three arches arising. Directed almost straight anteriorly is a long stout element, the hypohyal, 3 mm. long, with a dense cartilage core throughout. From the outer side of this hypohyal, a full fourth along its length arises, at right angles, the long, slender ceratohyal. Much of the posterior end is free from cartilage and loops about, probably a dim reminder of an epihyal.

From the end of each basihyal fork and continued in the same direction is the long, straight, slender, first ceratobranchial, 3 mm. long, unique in being of actual bone consistency. The distal tip is thread-like and hyaline, perhaps representing the epibranchial, and looping about, actually unites

with the corresponding filament of the ceratohyal, forming a closed visceral arch.

Returning again to the basihyal fork tip, we find a hyaline, tapering, posteriorly directed element, 1.5 mm. in length, representing all that is left of the second ceratobranchial.

Food: *Cnemidophorus* is wholly carnivorous and its food is found on the forest floor and open places, beneath leaves or at most a few inches up among low shrubs. Out of numerous stomach contents analyzed, the food of twenty-five individuals may be taken as representative.

Four young lizards: (1 to 4) 125 mm. or less in length, had eaten the following: 4 small orthoptera, 5 spiders of four species, 1 small grasshopper, 4 small beetles, 3 cricket nymphs, 2 green wire worms. Adult lizards: (5) 1 adult and 2 nymph grasshoppers, green caterpillar, brown spider, iridescent bee; (6) spider, geometrid caterpillar, grasshopper, 2 nymphs of same; (7) 2 wood roaches, grasshopper, orange wasp, robber fly, blue bee; (8) cricket, wire worm, 2 wasps, 3 caterpillars; (9) wood roach, 12 very small spiders and ants; (10) 3 spiders, dragonfly, small crab, grasshopper nymph, 13 ants, small bug; (11) caterpillar, 2 flies, beetle; (12) grasshopper, centipede; (13) 2 heteroptera, cicada; (14) beetle, roach, 2 wasps; (15) snail, 4 chalcids, grasshopper, bee, beetle; (16) ponerine ant, wasp, beetle, spider, caterpillar; (17) 2 hymenoptera, bug, spider, grasshopper; (18) caterpillar, beetle, mole-cricket; (19) long-legged fly; (20) 4 winged ants, 2 spiders, 2 grasshoppers; (21) beetle, 2 braconids; (22) roach, beetle, caterpillar, spider, centipede, flower bud; (23) 2 spiders, beetle, wasp, 6 ants; (24) 12 small beetles, chalcid; (25) Attention was called to a medium-sized *Cnemidophorus* because of its unusual weight. Its total length was 235 mm. yet its weight of 15.5 grams put it into the 285 mm. class of males. The secret of its weight was found to be the enormously distended stomach full of food, which equalled in brilliance of color its unusual quantity. There were three species of coccinellid beetles red, marked with yellow or white, a purple caterpillar, a small skipper butterfly with a gold patch on the wings and a small white moth, several spiders with red or yellow markings, wasps with red abdomens and head and thorax of shining gold, a brilliant yellow and black chalcid parasitic wasp and 3 green-winged grasshoppers.

A summary of the food record of *Cnemidophorus* is shown by a list of the chief ingredients of its diet, arranged in order of times of occurrence:

Beetles (18), grasshoppers (15), spiders (13), wasps (11), caterpillars (7), ants

(5), flies (5), roaches (4), crickets (3), heteroptera (3), bees (3), beetle larvae (2), centipedes (2), snails (2), and one each of the following, tail segments of *Cnemidophorus*, butterflies, moths, membracids, termites, dragonflies, mole crickets, crabs and flower bud.

Breeding: *Cnemidophorus* deposits two eggs at a time. Breeding seems to take place throughout the year, with greatest activity during or at the end of the rainy seasons as shown by the following records: January (1), March (1), May (2), June (5), July (3), August (3), September (1), October (1). Courting was especially noticeable in the months of May and September.

On January 13 I took a female containing two full-sized eggs placed in the oviduct side by side and measuring 7.5 by 16 mm. Ten other minute eggs were in the ovaries, one to two mm. in diameter, showing no signs of immediate development. On June 28 a female contained two half-developed eggs. A female on September 10 had two full-sized but as yet shell-less eggs, each about 10 by 15 mm., one lying in front of the other, distending her body. Two eggs in a female taken October 10 were about to be laid. They were 9 by 16 mm. and development had already begun.

At Caripito a female in captivity laid two eggs on May 21. They measured 8 by 15 mm. In the months preceding the rains, March and April, young lizards of this species were especially abundant.

Euspondylus sp?

General Account: Three specimens are recorded from Kartabo, but all have been lost. The data seem sufficiently definite to include the genus. Twenty-five years ago, in the field, my chief book of reference was Boulenger, and in my Journal I find these specimens named tentatively *Prionodactylus oshaughnessyi* as they were very close in appearance to the illustration in Plate XXI, Fig. 1, although they differed slightly in scalation. My notes were as follows:

Kalacoon, two specimens, one small, 1916. Black band to shoulder breaking up into eight large black ocelli along sides with white centers. Taken in thick jungle.

Specimen No. 198, Male, Kartabo, May 5, 1922. Caught near bamboos in laboratory clearing.

Dimensions: Total length 166.5 mm., head 13, tail 115.5, fore limb 17.5, hind limb 24 mm.

Color in Life: Head mummy brown, upper back amber, the outer and the two central dorsal keels very dark brown, forming four dark lines on the upper surface. A narrow, indistinct line of black from nostril to eye. Upper and lower labials spotted with black.

Upper surface of tail warm sepia. Band of dark buff from eye along back, bordered below by a narrow black line. Beneath this a broad band of red brown, in which are 8 to 10 black-bordered white-centered ocelli.

Below, pale grass green, changing to whitish on the snout. Under surface of tail light coral red, the edges of each scale lighter. Tail nearest the body grass green, each scale with a central black spot. Iris golden brown.

Iphisa elegans Gray, 1851.

(Plate II, Fig. 5).

Name: Red-bellied Skink.

Range: Northeastern South America.

General Account: At Kartabo I recorded three specimens, of which one is No. 21294 in the American Museum of Natural History. Specimen No. 553, female, February 5, 1921, Color Plate 309. Caught in jungle pit.

Measurements: Total length 158 mm., head 10, body 53, eye diameter 2.5, fore limb 7, hind limb 15 mm. Weight 2.8 grams.

Color in Life: Sepia above, which pales on edge of supraoculars, sides of head and body to form a narrow line of tawny olive. Ventral surface orange, deepening to grenadine on chin and orange vinaceous on tail. Iris black.

Specimen No. 638, male, March 22, 1922. Head 10 mm., body 50, tail 47 mm.:

Color in Life: Top of head, back and tail sepia, with narrow, latero-dorsal stripes of clay color. Sides of face, neck and body dusky brown, changing downwards to dark gray. Ventral scales drab gray, buffy on their edges. Chin and alternating ventral tail scales mouse gray.

Kentropyx calcaratus Spix, 1825.

(Plate II, Fig. 6).

Name: Striped Ground Lizard.

Range: Northern and western South America.

Field Characters: A medium-sized lizard of the jungle floor. Male purplish-brown in general, dull green on back spotted with black; female and young with three dorsal bright green lines, green on under side of head and fore body. In captivity this species is much more quiet than *Ameiva* and bites only on extreme provocation.

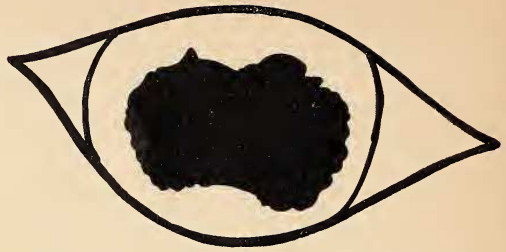
There is little difference in size between full-grown *Kentropyx*. The largest lizard I measured was a breeding female of 93 mm. head and body, and 303 mm. over all; the smallest was a female of head and body 37 mm., and 105 total length. The snout to vent, and the tail measurements varied slightly with growth, a decrease in the former from 35.2 to 30.6 per cent., and an increase of tail length from 64.8 to 69.4 per cent.

The weight of a young female of 130 mm. total length was 23 grams, and that of a 220 mm. female was 26 grams.

Specimen No. 255, adult male, Kartabo, 220 mm. length, December 18, 1920, Color Plate 279. Head dresden brown, lighter on neck, shading backward through greenish-yellow on anterior back to yellow bronze on rump. Eight or nine much broken transverse bands of black extending downward over sides from upper back. A narrow lateral line of brilliant orange yellow deepening to pure orange toward the tail. Below this a wide lateral band of rufous, occupying interspaces between black spots. Lower sides vinaceous fawn with thin scattering of minute black dots, and numerous large, round, greenish-white spots, arranged in eight or nine vertical rows extending down from the rufous band above. Ground color of limbs and tail russet, with black spots and irregular stippling. Sides of face dark tawny. All labials and sides of neck light purple gray, shading on chin and throat to pinkish-lavender. Ventral surface salmon color, darker on tail. New portion of renewed tail black. Iris flame scarlet. Pupil irregular in outline, somewhat hour-glass shaped, with many irregularities in the upper and lower pupil rim.

Specimen No. 203, young female, Kartabo, 105 mm. length, April 21, 1919. General color above black, striped narrowly with bright green. The green lines down the side of the back change to dull golden orange posteriorly. Front of head, sides and above dotted with golden brown on a green background. The latter color extends down the back of the neck and the mid-back changes to amber brown and dark chestnut on the tail. Lower chin and neck as far as angular fold, upper labials, sub-oculars and as far as tympanum and down the sides of the neck bright green changing into clear yellow-green. Upper surfaces of thighs and arms spotted with amber brown. Below, arms bronzy green, the rest of the ventral surfaces reddish-green. Pupil slightly irregular above and below, freckled orange-red.

Eye: In asymmetry the iris and consequently the pupil of *Kentropyx* are very close to *Ameiva* and approximate *Tupinambis*. (Text-fig. 10). No two are exactly alike. The adult male has a wide inner iris band of flame scarlet around the irregular inner border. The entire inner rim is irregular, lacking the even circular shape of the ordinary pupil. Above and below there are more or less deep nicks, usually an even concavity below, and an irregular outline above. At death the irregularities persist but to a less degree than in life. The iris in the young lizard is black, changing to orange in the female.



TEXT-FIG. 10. *Kentropyx calcaratus*—Pupil of eye showing irregularity of outline.

Breeding: Specimen No. 2704, taken April 18, 1924, and measuring 303 mm. in total length, contained four eggs almost ready to be laid. They were broad ovals, soft shelled, 9 by 17 mm.

Food: Three stomachs showed nothing but insects of various kinds, especially ants, termites and beetles.

Kentropyx intermedius (Gray, 1831).

Name: Striped Jungle Lizard.

Range: Northeastern South America.

General Account: In the field, the lizards collected from 1916 to 1924 were lumped as "*Kentropyx calcaratus*" and no distinction into two forms recognized. The one exception is Specimen Number 207, which was taken at Kartabo, October 1, 1917. It measured 160 mm. in length. In color it was pinkish-brown above with many broken bands of dark brown which became spots on the tail. A broad band of black extended from the eye down the sides of the body bounded by two pale lines. The head and neck were greenish on the sides, the sides of the body chestnut brown. Below, the head and neck were whitish, the body and tail pinkish-gray.

K. intermedius is far from rare, as sixteen specimens have been separated from the general collection of lizards of this genus taken at Kartabo. These are in the American Museum of Natural History and the Georgetown Museum.

Leposoma percarinatum (Müller, 1923).

(Plate III, Fig. 7).

Name: Dwarf Spiny Lizard.

Range: Northeastern South America.

Occurrence: This is a common species both at Kartabo and Caripito, on or under leaves in the jungle, chiefly nocturnal. It escapes by a sudden burst of speed or by hiding under the leaves.

General Account: This is a small (maximum length ca. 100 mm.) active, spiny-scaled lizard of the jungle floor. It is chestnut brown above with broad black lateral band.

These little lizards are seen occasionally

creeping over the leaves in the jungle but usually they are nocturnal. This is shown by the fact that out of 23 taken at Caripito, 14 had fallen at night into our pits. Apparently they travel less widely after the rains begin, as we took fewer then. Once, in mid-March, I found four close together under bark.

Their usual gait is lizard-like, but when alarmed they progress by short quick jerks, stopping now and then to examine any object of suspicion. In a pit these lizards would dash across the circular meter of floor so fast that the eye lost them completely except at start and finish. I have seen no animal which can equal this burst of speed. Among a tangle of moss and leaves when only somewhat alarmed, they writhe and wriggle their way, quite without help from their limbs.

Measurements: From a young female of 52 mm. total length to a breeding female of 80 mm., the relative length of the head plus body increases from 36 per cent. to 42.5 per cent. of the total length. The tail under the same circumstances shortens from 64 to 57.5 per cent. The fore limb averages 12.5 per cent. of the total length, and the hind limb 17.5 per cent. The weight of *Leposoma* varies from .85 of a gram in an 80 mm. lizard to one gram in a specimen of 92 mm.

Color in Life: Specimen No. 2965, female, length 52 mm., March 11, 1924, Color Plate 766. Dorsal surface entirely covered with chestnut brown, beginning above the tympanum, narrowing above shoulders, widening on mid-back and gradually disappearing on the tail. This dorsal brown is bordered below with light vinaceous buff in the form of a strong but narrow stripe, strongest on the forward half of the body. Top of head clove brown, pinkish at snout. Beginning back of tympanum, the sides are covered with a broad band of brownish-black, extending from the dorsal band to a broken edge on the lower sides or upper abdomen. Sides of neck mottled with brown. Labials pinkish-gray with large irregular black blotches which increase in number posteriorly, and merge below the tympanum into the lateral band. Limbs above brown with scattered spots of pale sandy. Tail brown, any renewed portion being black. Chin and neck dull flesh color with purplish tinge. Remainder of ventral surface deep olive buff, reddish under shoulders and yellow at vent. Iris very dark brown with a wide pupil rim of orange rufous, sometimes heightened to scarlet.

In Specimen No. 512, breeding female of 92 mm., taken June 19, 1919, there are six black bands which radiate downward from the eye and nostril regions, crossing both

lips on to chin shields. Aside from this regimenting of the labial blotches, the pattern and color are as in No. 2965.

A breeding female taken at Caripito, No. 30268, April 1, 1942, showed an orange band from eye back to mid-body, and below it was amber.

Food: The following were the stomach contents of four individual Kartabo lizards: (1) 4 small craneflies; (2) 16 springtails, homopteran nymph; (3) five termites; (4) two termites, four ants and a small caterpillar. A Caripito specimen had eaten a spider, roach and beetle.

Enemies: I found one medium-sized *Leposoma* lying dead at the edge of the jungle, showing no cause that I could discover. I caught a second under bamboos trying in vain to escape from army ants, two of which were clinging to its body and would soon have killed it.

Breeding: Specimen No. 512, Kartabo, June 19, 1919, 92 mm. in length, contained two eggs, lying alongside one another, ready to be laid. They were broad ovals, 4.5 by 8 mm., the shell deeply and irregularly corrugated longitudinally.

An egg found in a vivarium containing four *Leposoma* females was 3.8 by 8.5 mm. oblong with blunt, equal ends, and numerous longitudinal striae.

On March 6, 1922, at Kartabo, four eggs were found in groups of two, ten feet apart in leaves and other forest debris close to a fallen tree. The two sets differed somewhat in size and this was found to correspond with the development, those about to hatch being 7.5 by 9.8 mm. The shell was leathery, fairly soft, ivory white and covered with very fine striae as in the above eggs.

Of the set of smaller size, 6.5 by 8.5 mm., a contained embryo was 25 mm. long, pigmentation just beginning on the scales, head and snout very short and obtuse, limbs translucent so that bones and blood vessels were visible. On the tip of the tail was a curious persistent transparent extension of tissue resembling a fin of sorts.

On March 7 one of the first set of eggs hatched. The lizard was 40 mm. over all, the tail 23, and in general pattern and coloration identical with full-grown *Leposoma*.

At Caripito a lizard, No. 30072, was taken on April 28 in a pit and on the way to the laboratory deposited two eggs in a vial. The female measured 86 mm. over all; the eggs were 3.5 by 6.5 mm. Their unusually small size may indicate that eggs may gain in diameter by water absorption after deposition.

Neusticurus rudis Boulenger, 1900.

Name: Brown Water Lizard.

Range: Northeastern South America.

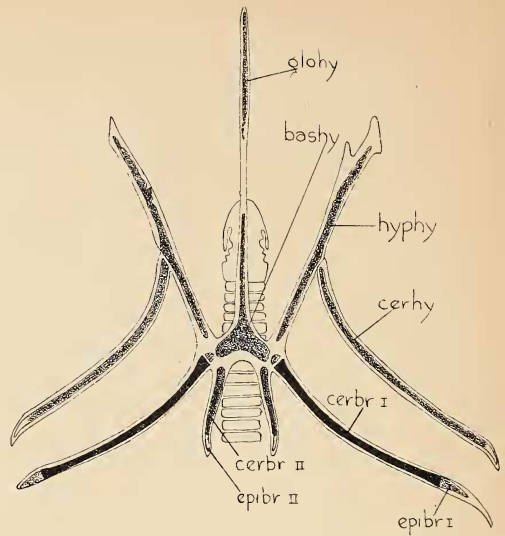
Occurrence: A rare lizard, of which I have notes on only five specimens at Kartabo and none at Caripito. It lives in holes in the banks of jungle streams and rivers and is a swimming lizard.

Measurements: Specimen No. 2638 with perfect tail, female, March 9, 1924, showed the following dimensions and percentages in total length. Total length 180 mm., head 15.5 (8.6 per cent.), head and body 60 (33.3), tail 120 (66.7), fore limb 23.5 (13) and hind limb 30.5 mm. (17 per cent.). The lizard weighed 4.5 grams. The largest lizard taken was No. 75, a female, with a total length of 235 mm.

Color in Life: Anterior head and face cold gray. Upper parts reddish-brown with wide, dark lateral band. The dorsal red is blotched with black and the lateral band spotted with whitish, sometimes so profusely that their color obscures the ground color. White below except for the tail which is brown like the upper surface. The tail is flattened and the lines of dorsal heavily keeled scales give it the appearance of a diminutive crocodile. Three supraborbital and a single suborbital spot bright mustard yellow.

Eye: The asymmetry of the iris puts this species in the same category with *Ameiva*, *Kentropyx* and *Tupinambis*. The background of the iris is black, densely freckled with brilliant apricot orange and with a thin line of the same color around the inner rim. In small specimens the iris color may be apricot buff. The pupilar edge is circular except for the upper-anterior portion, beginning at the zenith and extending forward for about 80 degrees. In this area a large curved projection, brilliant apricot orange in color, cuts deeply into the pupil circle and there are several toothed irregularities on each side. In one individual there were three small nicks in the lower portion of the pupil profile.

Hyoid: Coll. No. 75, Kartabo, female, KOH 2036, total length 235 mm., July 11, 1920. Text-fig. 11. The glossohyal consists of a very long, slender rod of cartilage. Just posterior to the glottis the spongy core vanishes and the hyaline rod becomes very attenuated but does not break as it does in *Ameiva* and *Cnemidophorus*. Anteriorly it increases in diameter and density again, ending half-way to the tip of the tongue. Posteriorly the urohyal bifurcates into the basihyals which form two, thick, short, truncated branches. The blunt tips of these form the point of attachment for three arches. Anteriorly the hypohyals extend obliquely outward, forming almost straight rods. The hyaline cartilage case widens in the distal half and a short distance from the tip of the left hypohyal there arises, on



TEXT-FIG. 11. *Neusticurus rudis*. Hyoid of adult. $\times 4$.

the inner side, a well-marked branch of unknown nomenclatural derivation. This is absent in the right hypohyal. The tip ends in an oblique, broad shoe. One-third of the distance from the base, a small, lateral, outwardly pointing process forms the point of attachment for the long, posteriorly and outwardly curving ceratohyal. The hyaline envelope of these elements widens somewhat distally and the rods sweep backward for a long distance, paralleling and gradually approaching the ceratobranchials. The end is free and possesses a very short curved tip.

The second attached element, at the bifurcated ends of the basihyals, is the elongated ceratobranchials of the first branchial arch. These are the most distinctly and strongly ossified elements of the entire hyoid structure, and each lies in paralleled proximity to the ceratohyals. The body core ceases abruptly near the extremity and gives place to an elongated phalanx-like bit of dense cartilage, and this in turn to a final curved claw of hyaline tissue. This latter may represent a vestigial epibranchial. Between the distal end of the basihyals and the proximal end of the ceratobranchials lies an isolated cartilage cap, perhaps all that is left of a hypobranchial.

The third element arising from the basihyals is the ceratobranchials of the second branchial arch, two short, straight, backward-pointing cartilaginous rods which end in a segment of hyaline cartilage.

Measurements: Total length of glossohyal 10 mm., basihyal 1.5, hypohyal 7.1, ceratohyal 8.2, first ceratobranchial 8, second ceratobranchial 2.8 mm.

Food: Two stomachs were examined. One contained a small unidentifiable poeciliid fish and the remains of 2 tadpoles. The other had many small fish scales, a water beetle and the chewed remains of at least three tadpoles.

Enemies: My only record is an indirect one. *Neusticurus* Number 78 was picked up on the ground near the laboratory, freshly killed, still bleeding, with the left hind foot and the tail bitten off. It may probably have been dropped by a hawk but this is only a guess.

***Tretioscincus bifasciatus* (Dumeril, 1851).**

Names: Blue-tailed Skink. Lucia (Venezuelan name).

Range: Northeastern South America.

General Account: Rather uncommon. Captured or saw only five or six at Kartabo and the same number at Caripito. This lizard is terrestrial and lives usually in fairly open jungle under leaves and fallen logs. Occasionally comes into the laboratory.

Measurements and Color in Life: Specimen No. 30,110, Caripito, May 18, 1942, Color Plate 1577. Total length (renewed tail) 115 mm., head and body 50, tail 65 mm. Body above in general black, with two lines of creamy white, and tail brilliant cobalt blue. The two upper white lines extend around the tip of the snout where they are reddish-buff, changing gradually posteriorly to cream and finally to white, and at the tail merging into the bright blue. The center of the head above is rufous changing on the back into black and persisting on the tail as a median band of black dying out half-way down the tail. The sides of the head and body are black. This bounded below by a second pair of bluish-white lines, beginning on the upper labials, and widening into a strong white band from the ear to over the shoulder and from here below the lateral black, becoming an interrupted line of short white dashes to the thigh. From the lateral narrow white line to the mid-abdomen, the scales are first black with narrow edges of bluish-white, and from this first line downward there is less and fainter black and more blue. Below, chin and throat immaculate bronzy white, chest and abdomen bluish-white. Iris black.

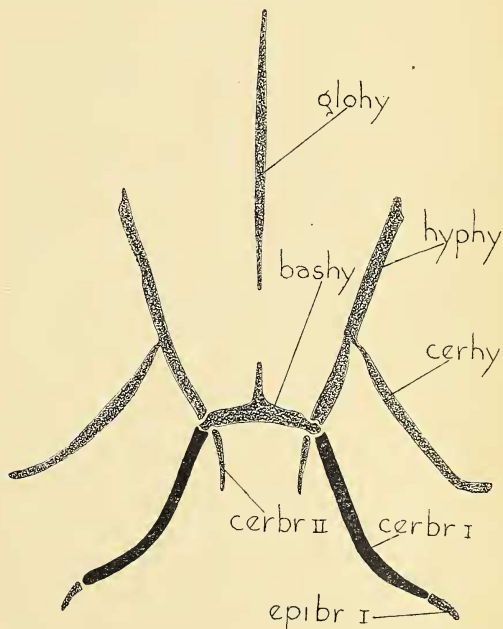
The terminal 35 mm. of the tail is regenerated growth. The last original segment contains a circular count of 25 scales. The first regenerated segment has 29 scales.

Another specimen, No. 30,127, has 45 mm. of new tail. The junction as to size is perfect, but the last original segment shows a circumference count of 12 scales, while the first renewed segment touching it has 24 perfect scales. The dorsal black line stops at the break but the pale ventral areas are

reproduced as in the original appendage. This specimen has a total length of 140 mm. and weighed 6 grams.

Another specimen, No. 30,127, taken June 2, 1942, at Caripito, has the two uppermost dorsal lines bright gold instead of creamy white. The same is true of Specimen No. 729, Kartabo, Color Plate 531.

Hyoid: Spec. 30,127, KOH 2,508, Caripito, June 2, 1942, total length 140 mm. Text-fig. 12. All the hyoid elements except the first ceratobranchials have a loose, granular appearance, with indistinct annulations. The outlines are fairly definite but the caliber varies slightly. The glossohyal is very slender and long, 6.5 mm. over all, with a wide hiatus close to the base. Proximally it joins the basihyals with almost no enlargement. The latter show the merest suggestion of an arch, being in general appearance a heavy, almost straight transverse bar, 1.7 mm. in length, very slightly and shallowly concave below.



TEXT-FIG. 12. *Tretioscincus bifasciatus*. Hyoid of adult. $\times 5.5$.

From the outer end of the basihyals arise, at a 45 degree angle, slender, straight rods, 4 mm. long, the hypohyals, of equal diameter throughout, and with the tips dying out in loosely knit points. Two-fifths from the base of the hypohyals the ceratohyals take their origin at a right angle, the junction being by a thread-like osseous extension. These have a decided outward curve, and the granular tips show no definite hint of epihyals.

From the ends of the basihyals the first ceratobranchials arise, at a slightly greater than right angle with the hypohals. These elements are 4.75 mm. in length, bent in an outward direction, and of real bony appearance, homogeneous and with firm outlines. Their base occupies the entire truncate extremity of the basihyals, and these bases show a substantial collar, and a definite bony cap. Short first epibranchials are visible. From the postero-external surface of the hypohyals arises a tiny needle of bone, one millimeter in length, all that remains of the second ceratobranchials.

Tupinambis nigropunctatus Spix, 1825.

(Plate III, Fig. 8; Plate IV,
Figs. 9, 10 and 11).

Names: Tegu. Salempenta (British Guiana Creole), Ah-lee-cah-bah (Akawai Indian).

Range: Northern and Central South America.

General Account: Common, by which I mean that when searched for, a tegu can usually be found, both at Kartabo and Caripito. It is terrestrial but with sufficient climbing ability occasionally to obtain food and to nest well above the ground.

The tegu is a large, heavily-built lizard, with considerable pattern and color variation. In general it is black above, spotted and blotched on head and body and broadly banded on tail with bright yellow. Head, body and limbs below straw yellow. The young are banded from nape to tail tip.

Measurements: The tegu is second in size only to the iguana and is much heavier in body than that lizard. The average length of a dozen full-grown males, all with perfect tails, is 757 mm., the largest being 780 mm. Females of the same relative size average 768.3, the largest being in full breeding condition 835 mm., or something over 32 inches over all. Adult males weigh on an average 665 grams, and females 683.4, the heaviest being the large breeding female weighing 910 grams or almost exactly two pounds.

Femoral pores vary in the males from 10 to 12, averaging 11 on each leg, and the females possess from 10 to 13 pores with an exact average of 12.

An adult male shows very slight change in relative measurements compared with a newly hatched tegu or even a late embryo. The percentages of various parts into total length are as follows: Adult male and late embryo, total lengths 730 and 176 mm., eye diameters 1.23 and 2 per cent., snouts to vents 35 and 37.5, tails 65 and 62.5, fore legs 13 and 15, hind legs 25 and 28.4 per cent. We observe only a slight relative in-

crease in size of eye, and length of body and limbs in the embryo.

Color in Life: Late embryo, female, Specimen No. 2784, length 180 mm., April 17, 1924, Color Plates 702, 1110, Photograph 677. In general the color was pinkish-flesh, with all the dark cross bands of the new hatched tegu in very pale gray. The only pattern peculiar to this early stage is an interrupted lateral band of black extending from the eye along shoulder and thigh back to the tail. Another pattern of unusual prominence was four longitudinal series of white dashes down the back from nape to three-fourths the length of the tail.

Newly hatched male, No. 2942, June 12, 1924, length 247 mm., Color Plate 762. Pattern in general: head spotted and blotched; body, limbs and tail crossed with many wide bands of black. Using Ridgway's Color Key, the colors in detail are as follows: Above isabella color on head, honey yellow on anterior back shading to isabella again on lower back, olive on proximal and colonial buff on distal half of tail. Fore limbs deep colonial buff, hind limbs isabella; all toes grayish-olive. Head scales with large patches of very dark brown with dull brown mottlings toward snout. The back has 12 transverse black bands beginning at nape, very irregular, some split on one side. These extend down over sides, narrowing and ending at edge of ventral surface. There are also widely scattered fine spots of empire yellow, which take a vague arrangement of lines down the sides of the dorsal region. The tail has 15 cross bands, the first six narrow, the others gradually widening, the interspaces also widening slightly. The tail bands extend around the entire tail. The limbs are irregularly banded with black, the posterior surface being very dark brown speckled with dark honey yellow. Sides of face in front of eye mottled with light brownish-olive. Broad band of black from and up over tympanum, which is dark gray with a pinkish tinge. Sides of face, back of eye and lower labials with irregular scattered patches of black. Chin ivory yellow, other ventral surfaces barium yellow with scattered, square-edged patches of black. Pupil rim pale gold, very much broken at tip and bottom with large, rough-edged points, with crescent patches of very dark brown each side. Rest of iris dull greenish-white with gray stippling.

Newly hatched female, No. 2943, length 243 mm., June 12, 1924, Color Plate 762. As typical of individual variation in this species, this specimen, which was sister to No. 2942, differed from it in having fewer black spots on the face and none at all on top of the head in front of the orbits. The dorsal bands much more broken. Limb

bandings reduced on anterior surfaces to a few blotches of dark brownish-gray. The whole lizard has a generally greener tone, the snout region being dull citrine, ground color of the body olive, and the tail char-
treuse yellow.

One-third grown male, No. 711, length 295 mm., August 15, 1922. Above black. Edges of head scales, irregular banding on back (broken on neck), fine spots on limbs, tail bandings all light olive green. Upper eyelid, streak under eye, two rows of small dorsal spots and two dorso-lateral rows straw yellow. Side of face mottled olive green, with dark streaks toward tympanum. Lower labials yellow with four strong black spots and another above. Sides of body with mottled bands of empire yellow which become more solid and lemon chrome and finally olive green on tail. Tail deep slate green. Below amber yellow heavily spotted on throat and under arms with black, and with heavy black banding on lower sides of body, thighs and tail. Iris generally dull gray with scattered points of pale gold which are concentrated along the irregular pupil rim.

Male breeding, No. 2961, length 730 mm., June 16, 1924. Black above. Head scales edged with yellowish-green. Sides of snout mottled with olive and dark gray. A dark line backward over tympanum. Ten very faint cross bands on body, faintest on lower back, composed of small, scale markings which become thicker and change to buff on lower sides. Fifteen bands on tail, nine proximal and very faint, six distal widening and changing to dull buffy yellow. Scales on upper limbs deep colonial buff, with black spots which increase and merge with the black posterior region, which is faintly dotted with reed yellow. All toes buffy olive darkened with black scale edgings. Ventral surfaces, picric yellow on throat, lemon yellow on body with scattered black spots. Ventral sides of body touched with lime green. Iris as in young.

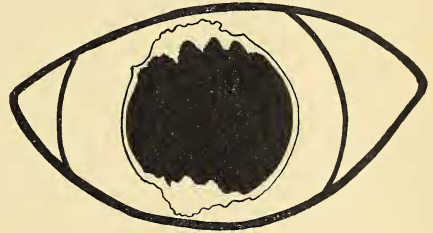
Adult female, No. 3518, length 765 mm., June 22, 1924. Much as in No. 2961, except that the dorsal bands have wholly disappeared, being merely a generally symmetrical scattering of tawny olive spots scattered on the back and the sides of the body into cabalistic markings and forming indistinct bands on the outer sides of some of the ventral scales. Tail bands are indistinct and broken and turned pinkish-buff posteriorly. Ventral coloring much duller, all surfaces straw yellow. A few bluish-gray blotches on chin. Ten bands are barely discernible on the distal half of the tail, but all the proximal area is covered with irregular fine spots of olive.

Adult male, No. 1820, length 745 mm.,

July 28, 1920, Color Plate 147. In this fully adult lizard the numerous black bands on body, limbs and tail characterizing the young, have completely disappeared.

Head black with irregular mottlings of dresden brown. Lower labials and chin shields ivory yellow, faintly mottled with pale blue. Body black with irregular spots of bright cadmium yellow, deepening to water green beneath the tail. Legs and feet black above with numerous spots of honey yellow, deepening to light brownish-olive on toes. Tail with dull patterning of black and dark olive green.

Eye: Details of several irides will be found under color descriptions. Text-fig. 13. The following is typical of an adult tegu. Adult male, length 745 mm., July 28, 1920, Color Plates 147 and 1175. Iris empire yellow and gold, flecked with orange, with jagged, toothed edges at top and bottom of pupil. A narrow irregular rim of gold at sides of pupil, the remainder dark greenish-brown flecked with black. Pupil slightly flattened vertically and irregularly denticulated at top and bottom. This asymmetry is apparent in the newly hatched lizard and there is some variation, but the top and bottom sharp teeth characterize this species.



TEXT-FIG. 13. *Tupinambis nigropunctatus*. Pupil of eye showing irregularity of outline.

Food: The tegu is an omnivorous feeder in the widest possible meaning of that term. No phylum of animals is refused, whether the organisms are small or large, living or long dead. A large number of plants, leaves and berries are taken. I saw them feeding many times on plants which I had thought poisonous. Both in Kartabo and Caripito we found that unguarded hens' eggs, chicks and full-grown domestic fowl are taken at night. In a letter written to me by Mr. Edgar Beckett in 1919 he says, "I know very little about the details of the regular diet of salempentas, but fowls' and lizards' eggs and chickens are favorites. My nephew wounded a plover and as it was only slightly hurt, he tethered it with a string under the house. In a short time he found a large salempenta on the end of the string, having swallowed the bird. The blacks and coolies

have a deep belief that these lizards often disinter shallow buried human bodies and feed upon them. It is quite possible."

A dozen stomach contents will give a cross section of the food of the tegu around the laboratory in the jungle at Kartabo and Caripito. (1) Five large cokeyao berries, young *Cnemidophorus* lizard 175 mm. in length, two small spiders, large tarantula-hawk wasp; (2) Long-horned grasshopper, crab, several dead leaves, six yellow-fleshed fruits; (3) Hair, bones and skin of spiny rat, large beetle; (4) Beetle, roach, three centipedes; (5) Mass of chewed-up insects, leaves, hunting wasp, bones and feathers of tinamou from the laboratory garbage dump; (6) Large red berries, several winged queens of *Cryptoceros atratus*; (7) Skull of jungle mouse, large cone-headed grasshopper; (8) Large *Passalus* beetle, medium-sized *Ameiva*, three seeds; (9) Centipede, grasshopper, small snake; (10) Mass of egg yolk, *Leptodactylus* frog; (11) 18 yellow fruits; (12) Three worker *Nasutitermes ephratae*. (This tegu had just hatched in a termite nest and these insects were eaten before I captured him.)

Breeding: Direct or indirect evidence of six separate nestings of tegus in the nests of termites were found at Kartabo and Caripito. These varied from two feet above the ground to as high as twelve. Five were three to four feet up in low growths. Details of one nesting will be found under the heading General Habits.

On June 16, 1919, our Indian hunter brought in a big termites' nest with six tegu eggs buried near the center. We had to hack and saw the nest material away. In places it was so hard that it seemed like excavating fossils from their bed of rock. The Indian has found as many as 12 eggs in one nest. The eggs were oblong, round ended, the entire shell concealed by a thin, smooth layer of the termite building tissue. Beneath this there was a yellow stain and where the termite material came away clean the white leathery shell was exposed. The whole gave the appearance of a half-scraped nut. The eggs were laid irregularly, some end up, some sideways. Several were touching, others isolated. The weights of three, free from encompassing material, averaged 34.2 to 35.2 grams. In size they measured 36 by 48.5, 36 by 49 and 34.5 by 51.8 mm. The embryos were only slightly developed.

Specimen No. 711, length 835 mm., August 21, 1922, had six enlarged, subequal but shell-less eggs in each of the two ovaries. All would very evidently have matured at the same time. On April 20, 1924, I flushed two mating tegus, which separated at once and tore away at full speed through the jungle. Breeding lizards were found

in April (3 records), May, June (2), and August (2).

General Habits: On April 16, 1924, a nest of four tegu eggs was located in a large termite nest in a bamboo clump about one hundred yards west of the laboratory at Kartabo. The four eggs were visible not more than two inches beneath the surface of the nest. The least touch made the surface swarm with the insects, which were *Nasutitermes ephratae* (Holmg.). Nymphs and adults of the large red and black assassin bugs crawled over the nest feeding on the owners.

The discovery of the tegu eggs was wholly accidental, due to a sudden, severe storm the night before, which so thrashed the bamboo stems about that even near the base the movement was sufficient to split apart a portion of the nest and to expose the eggs. No white shell was visible, only the dark brown nest tissue spread over the vaguely oval forms.

I took one of the eggs but did not disturb the others. A fine mesh wire was then fastened over the whole nest, encircling the stems of the bamboos around which the nest was built. The egg which I took contained a very large embryo with a total length of 180 mm., and only a very small attached yolk sac. The lizard was very lively, opened and shut its mouth and tried to walk about. It was pinkish-flesh color with the dark markings fairly indicated but very faintly. (No. 2784, Color Plates 702 and 1110).

Several times since this April 16th I visited the nest and found the cavity we had made completely filled and resealed by the indefatigable insects. I had estimated that ten more days would have seen the embryo normally hatched and out of its shell, so I naturally expected a corresponding early hatching of the remaining eggs. I found that my estimate was far out. Week after week passed with no indication of emergence. The unnatural drought of this particular March and April lasted until May 11, when the rains began with an equally unusual amount and duration. The rains lasted with but little intermission until June 12, when I visited the nest again. I found that one of the large bamboo stems had broken off and fallen a little from its old position, wrenching the wire open at the point of juncture around the stem, resulting in a good-sized opening more than large enough for a newly emerged tegu to escape to the outside world. Near the bottom, however, I discovered a newly hatched tegu in person, and by closing up one opening and making another I secured it. It attempted to bite but I found that it had little strength, not nearly as much as the jaws of

a *Thecadactylus* or *Polychrus*. It had made its escape when the nest was still uninjured, not through the side way, where three inches would have reached the surface, but through a tunnel straight downward to the base of the nest. This means of egress was fourteen inches in total length and the tunnel was perfectly straight and through some exceedingly hard layers. It was so well-marked and permanent that I was able to preserve a section of it. Digging in I came upon the shrivelled egg-shell, still soft and damp. When I later distended this with cotton to almost normal size its surface was seen to be covered with a number of small round holes which I thought at first had been made by the teeth of the young lizard. Closer examination showed evidences of external gnawing, so it was probable that the holes were gnawed by the termites after the emergence of the lizard. Near the empty shell was another egg, perfect and very heavy, which I took. If this had hatched, the lizard would have been so near the tunnel already made that it would have had little or no excavation to do on its own account. So close together were the eggs that the first tegu to make his way out doubtless does the major part of the work for the rest.

At my desk in the laboratory I noticed that a few drops of yolk were escaping from one end of the whole egg, and found a small hole made doubtless by my tool when I was digging it free. I began to enlarge this and had it half an inch across, when I felt a terrific commotion within the shell and without any warning the enclosed tegu shot out like a catapult from the *opposite* end of the egg, scrambled across my knees and back on the table again where it stood looking around and feeling about with its tongue as if it had had two weeks instead of two seconds experience of life. There was almost no liquid left in the shell and the navel of the tegu was quite dry and hardly at all protuberant. The little lizard eluded my first effort at capture and rushed down behind my desk and behind an upright beam where three of us captured it with difficulty. It tried constantly to bite but could not make any impression on my skin. Its claws, however, were sharp and powerful and when put in a glass dish it struck the sides again and again with its nose and claws. It is probable that these lizards make their way through the tough termites' nest by clawing and by pushing with the head rather than by any use of teeth and jaws.

This egg, five minutes before hatching, weighed 33.3 grams and measured 34 by 52 mm. It was wholly covered with the dark brown deposit of termite building mate-

rial. The shell was soft and leathery and wherever freed of débris was creamy white, with deep, sharply marked, irregular, longitudinal reticulations. The opening through which the lizard escaped was a symmetrical hemispherical slit occupying almost the terminal third of the egg, 20 mm. in width and about the same in height. As there was no sign of an egg-tooth the fracture was probably the result of direct pressure against a normally weakened area. The head was directly against the point of fracture, hence enabling the tegu to keep up its straight away dash, without turning, from the instant of breaking through.

The astonishing viability of newly hatched organisms was plainly shown by the tegu which I found already hatched in the nest. I placed it in 50 per cent. alcohol and after a short period of thrashing about, it sank and remained quiescent for an hour and a half, when I removed it for study. Its eyes soon opened, it began to breathe naturally, and presently it was as strong and as active as ever, quite unaffected by its prolonged immersion. Not until I added the fumes of chloroform did the lizard expire for good. This was a male, No. 2942, length 247 mm., Color Plate 762.

Within a half hour after hatching, tegu number two (No. 2943, length 243 mm., Color Plate 702) began to shed its skin, although when it emerged its colors were bright and clear and there was no trace of the coming sloughing. The shed embryonic skin was as strong and perfect as that of any subsequent ecdysis. The tongue was a decided pink in color and was frequently extruded as in the adults. In a shallow glass dish the newly hatched lizards made no attempt to climb, although an elevation of two inches would have taken them over the edge. They strived only to force their way downward or straight ahead. This is rather significant in connection with the fossorial habits of the adults. There was a considerable difference in coloration in the two young tegus and the pattern also was unlike (See under Coloration).

***Amphisbaena alba* Linnaeus, 1758.**

(Plate V, Figs. 12 and 13).

Names: White Burrowing Lizard; Double-ender Snake, Blind-eyed Snake, Cushie-ant Snake (Guiana Creole Names); Poong, Arrawhy-oo (Akawai Indian name).

Range: Tropical South America.

General Account: These lizards are not uncommon both at Kartabo and Caripito, but are seldom seen except during heavy rains or when uncovered by digging. They live beneath forest débris or down one or two feet in the ground, and also in the nests of attas and other ants.

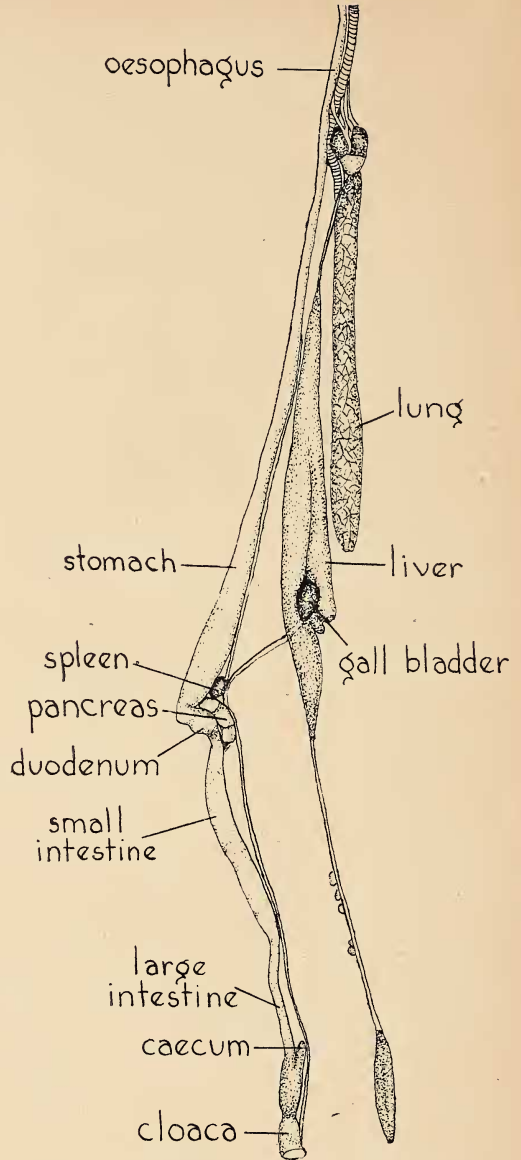
They are legless, snake- or worm-like lizards, growing to two feet in length, thick bodied, cylindrical, with minute eyes, equal ended, and are dark brown above, shading to creamy white beneath.

Specimen 346 was caught while crossing a jungle trail in the rain. Its reactions, strength and other characteristics are similar to those of *A. fuliginosa*, except that its mode of progression is in a straight line and not curved or bent. On a smooth board its rate is rather slow, but on earth, moving from an open space toward shade, it made three successive meters in 23, 16 and 13 seconds respectively.

When progressing steadily, the slightest touch anywhere on the body causes an instant reaction, comparable to a steel spring. The head and the head-like tail are raised at the same angle and to the same height, the body at this moment being stretched out straight. With not a fraction of a second's delay the final position between the two extremes is attained and held motionless. This is slightly bowed with the two ends raised, the body in striking position and after the confusing double flexion has been completed it is very difficult to tell which is head and which tail, and the same must apply to any enemy not familiar with the anatomy of the creature. The shape, contour and pigmentation of the head, and even a small dark spot simulating the eye characterize the tail.

When progressing, three waves of undulation of about twenty segments each, are plainly visible. The tail, however, takes no part in this function, and remains steady, being dragged motionless along, awaiting its important part the moment the body is touched, or the lizard alarmed. After the curved, frozen position of alarm, the first motion discernible is in the tail which is slowly lowered and appears to feel about, exactly as does the head in serpents.

Specimen No. 30,185 was taken at Caripito June 13, 1942, in Pit Thirteen. I find the following notes: Tried now and then, when handled, to twist and bite. Was exceedingly powerful especially in pushing ahead, lifting up the copper wire on its cage, supporting itself on the posterior fifth of its body, and even wedging partly through half-inch soldered wire mesh, until ten bricks were piled on top. It escaped three times and travelled in an absolutely straight line down the long corridor of the laboratory to the darkroom. The successive waves consisted of twenty segments each alternating with twenty quiescent segments. In sun after being handled and photographed, it steadily attempted to escape, occasionally lifting the tail alone and progressing backward with as great facility as ahead. In the



TEXT-FIG. 14. *Amphisbaena alba*. Gross anatomy.

pit at time of capture it began boring into the side, so swiftly that I just saved it by getting hold of the tail. It took all my strength gradually to drag it out. Even in hard clay its hard skull and powerful muscles allowed it to drill steadily by sheer force.

Measurements: Specimen No. 346, male, Kartabo, June 13, 1920. Measurements—actual and in percentage of total length, as follows: Total length 480 mm., snout to vent 441 mm. (92 per cent.), tail 39 (8), body depth 12.5 (2.6), body width 18 (3.75), body annuli 220, tail annuli 21, mid-body segments circumference 73, dorsal segments

31, ventral segments 42, preanal pores 8, weight 83.9 grams.

A female of 540 mm. total length showed the same relative figures as to body, tail, segments and annuli, but possessed ten instead of eight preanal pores, and weighed 143.2 grams.

Color in Life: Specimen No. 346 had the snout back to the eyes and the chin shields pale pink. Above dark brownish-yellow shading to old ivory below, the tail mottled with dead white. Eye showing pink beneath its scale.

Gross Anatomy: Coll. No. 346, Kartabo, June 6, 1920. Text-fig. 14. The oesophagus is extremely elongate, opening into a long stomach which is constricted at the pylorus. The duodenum is slightly enlarged as it leaves the stomach, then constricted into an hour-glass shape, giving the entire organ the appearance of a tiny gizzard with a large proventriculus. The pancreas is small and short. The bean-shaped spleen is placed above and just touching the pancreas. The small intestine is not looped though somewhat twisted, and there is a small caecum at the beginning of the rectum. A constriction occurs between the rectum and the cloaca, the latter organ being enlarged. There is one lung.

The liver is extremely long, running to a fine point at both ends, connected to the heart by the post-caval vein which is very large. The liver is single lobed, but running from the gall bladder anteriorly is a shallow crease or groove in the tissue of the organ which gradually dies out. This probably represents the only separation into right and left lobes. The gall bladder is large and oval. Measurements: total length 480 mm., weight 83.9 grams, liver 1.8 grams, lung 151 mm., small intestine 118, large intestine 22, duodenum 8.5, spleen 6, cloaca 18 mm.

Food: A thirteen-inch specimen had eaten a mole cricket, grasshopper and three termites.

***Amphisbaena fuliginosa* Linnaeus, 1758.**

(Plate V, Figs. 14 and 15).

Names: Black-and-white Worm-lizard; Two-headed Snake, Cushie-ant Snake (Guiana Creole names); Poong, Arra-why-oo (Akawai Indian).

Range: Tropical South America.

General Account: This is a common species, both at Kartabo and Caripito, more frequently seen in daylight above ground than *A. alba*. At night or in heavy rains it may be met crawling about the forest floor or open trails. More often it is dug up in sub-soil depths of six inches to two feet, and is also found in ant nests. It is a burrowing, legless lizard, dark brown or black

above, pale below, both colors encroaching more or less on opposite areas in narrow, shorter or longer circumferential lines.

This specialized lizard is exceedingly powerful for its size, twisting with great force when held in the hand, and if held loosely revolving rapidly attempting to bite. It can seize and bite through several thicknesses of paper. One which seized the side of my thumb drew blood at once and the jaws had to be pried open with forceps. The tail is stronger than the head and when looped over a support the animal can hang suspended by the tail for some time, feeling about in mid-air with its head for support.

Like *A. alba* it progresses by successive annular undulations, worm-like, keeping, however, a permanent bend in the body which increases its leverage so it can make faster speed. When touched or suddenly alarmed, the movement changes to a lateral serpentine progression for a few seconds. It feels constantly about with its tongue.

Measurements: As extremes taken by us, Specimen No. 30194 was 180 mm. and No. 935 was 412 mm. over all. In all sizes the ratio of tail to head and body is 13.5 per cent. The relative weight ratio to length is almost the same at all ages. A specimen of 180 mm. in total length weighed 9.6 grams, 300 mm. weighed 16 grams, 355 mm. weighed 20 and a 401 mm. specimen weighed 24 grams.

Color in Life: The pattern and coloring of this species are wholly unlike those of *A. alba*. The latter is dark above the pale beneath, but dorso-ventral transition is even and gradual. In *fuliginosa* the boundary of pigmentation is controlled by the annuli and the segments, and there is presented a bewildering variety of patterns, always, however, dominately darker above and lighter below. In the majority of individuals the head is immaculate, with an irregular dorsal patch around the eyes in about 40 per cent. Brief descriptions of several lizards both from Kartabo and Caripito, together with the illustrations, show these variations.

Color Descriptions Showing Variation: Specimen No. 3268, Kartabo, length 220 mm. Head and first two annuli white except for wide interorbital band of pink. Black above with scattered pink, no long lines, almost all flecks. Below pink with many cross lines of black, mostly single but many of these crossing mid-line.

Specimen No. 2941, Kartabo, length 225 mm. Dominately black above, white below. Head, chin, throat and two annuli white except for an irregular black patch on mid-snout, between eyes and on right side above, behind eye. Black above with numerous flecks, single, double and triple short linear

intrusions of dorsal black, but almost never across.

Specimen No. 3254, Kartabo, length 230 mm. Head, above and below, and four annuli salmon. Above black with short dashes and flecks very abundant. Below salmon pink, with sparse scatterings of single linear intrusions, six across mid-line in isolated places.

Specimen No. 237, Kartabo, length 320 mm. (before tail was broken). Head pink back to first annulus above, third below; the dorsal mark a small central triangle on middle of second and third annuli. Above black, broken by occasional cross lines and many shorter ones of pink. Below same, with colors reversed, pink crossed by black. A decidedly black amphisbaenan, lined and cross-lined with pink.

Specimen No. 935, Kartabo, length 412 mm. (before tail was broken off). Head, including first annulus, chin and throat white. Above dominantly brown with many irregular lines and flecks of ivory white, many extending clear across. Below same, with colors reversed, many extending across.

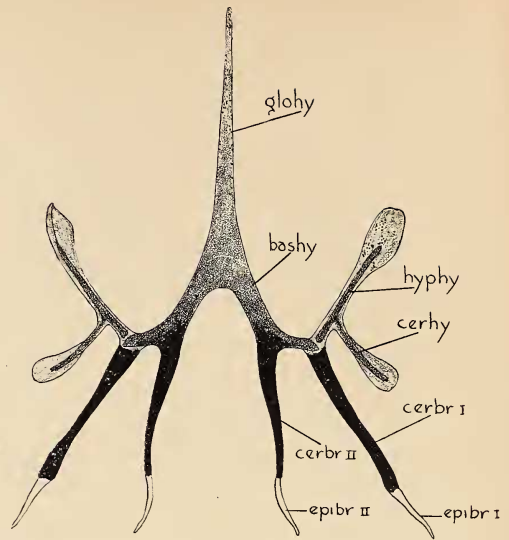
Specimen No. 30,194, Caripito, length 180 mm. Head back to fourth annulus, chin and throat immaculate. Above blackish-brown, with many flecks and short lines. Below white, unspotted. Dorsal black visible as short lateral lines here and there, crossing mid-ventral only four times under tail.

Specimen No. 30,269, Caripito, length 280 mm. Above dark brown with many annular lines of white. Head to third annulus white, with irregular blotch between eyes. Below scattering of single or rarely triple pigment ends of dorsal brown, crossing in mid-line only on twelve annuli under tail.

Specimen No. 30,153, Caripito, length 286 mm. (when alive before breaking off of tail). Above black with few scattered flecks of ivory yellow. Head and first two annuli with large irregular blotch on top of head from mid-snout to back of eye. Below chin and throat white. Black encroaching in many single, double and triple annular streaks, leaving narrow interspaces of yellowish. In only three places extending across mid-ventral lines. Pores right 3, left 4.

Eye: The small and deep sunken eye is merely a dim spot of pink with a faint central dark speck of a pupil.

Hyoid: Text-fig. 15. The glossohyal is long and tapering, about 4 mm. in length, ending anteriorly in a blunt point while posteriorly it widens gradually and merges into the basihyal arch. These are stout, branched elements, and each limb expands behind into an outwardly directed, flat-bottomed shoe. From the tops spring the hypohyals at about 50 degrees in a forward direction. The osseous part of this element



TEXT-FIG. 15. *Amphisbaena fuliginosa*. Hyoid of adult. $\times 7.5$.

is a straight rod, but it is surrounded by translucent cartilage-like tissue which expands distally into a wide fin extending well beyond the tip of the hypohyal core. This terminal expansion of the left hypohyal differs considerably in shape from its opposite fellow. Posteriorly and about one-quarter out from the origin of the hypohyal arises, at right angles, the short ceratohyal, of the same shape and three-fourths as long as the hypohyal. This too is surrounded, except at its base, by a wide fin. The hypo- and ceratohyal cores are united, but the former is distinct from the shoe tip of the basihyal. From this latter juncture the first ceratobranchials extend obliquely backward for about 3 mm., rather stout rods, ending in long, slender first epibranchials. From the inner portion of the basihyal shoes and continuing the limbs of the arch, the second ceratobranchials take their origin, more slender than but equally long as the first ceratobranchials, and also bearing well developed second epibranchials.

Food: The contents of four stomachs were as follows: (1) Mole cricket, grasshopper nymph, 6 ants; (2) 2 beetles, cricket nymph, 2 termites, many small bits of quartz; (3) 10 ants, 11 termites, roach, many transparent bits of quartz; (4) 15 termites, wire-worm, 2 rootlets.

Mabuya mabouya mabouya (Lacépède 1788).

(Plate V, Fig. 16).

Name: Brown-lined Skink.

Range: Mexico and the Lesser Antilles south to Boliva and Brazil.

General Account: These skinks are occasionally seen or captured but they are so

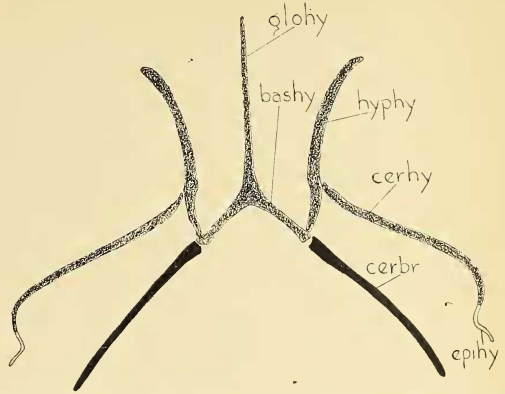
protectively colored that they are probably more common than observations would indicate. They are terrestrial inhabitants of the jungle floor. Characteristically their scales are smooth and flat. Above they are olive with a bronze sheen and a broad, dark brown lateral band extends from snout to tail, bordered below with pink. The under parts vary from sea green to sulphur yellow.

Measurements: In size these skinks range from the 91 mm. total length of a new-born individual to a female of 265 mm. over all. The weights of the same two lizards were 1.2 and 21.5 grams. Dimensions in percentages of total length (tails perfect) of a day-old male and its female parent are as follows: Total lengths 91 and 245 mm., head lengths 9.1 and 8.8 per cent., snouts to vents 45 and 42, tails 55 and 58, fore limbs 13.7 and 10.6, and hind limbs 19.8 and 14.5 per cent. This comparison shows a slight relative reduction in head and body length in the adult, and a greater reduction in lengths of fore and hind limbs (3.1 and 5.3 per cent.).

Color in Life: Specimen No. 223, male, length 150 mm., July 24, 1920, Color Plate 179. Head at snout deep colonial buff with over-sheen of citron green, deepening posteriorly through pale mustard yellow and old gold with over-sheen of tawny, to light yellowish umber, and finally on the tail to dark olive with over-sheen of olive green. Wide lateral band, from just in front of the eye backward, sooty black with narrow, broken inferior stripe of cream color. Side of face pale orange yellow. Upper labials shell pink with over-sheen of deep seafoam green. Lower labials chartreuse yellow, fading to pale sea green on throat. Ventral surface pale sea green deepening to dull blue-green. Iris dark brown.

A second lizard, No. 1923, male, had the under parts sulphur yellow.

Hyoid: Spec. 953, KOH 2509, Kartabo, September 9, 1922. Text-fig. 16. As in *Tretioscincus* all the hyoidean elements of this species, except the ceratobranchials, are of loose, granular structure. The slender glossohyal narrows throughout its length, and is 5.25 mm. long. It forms an exact triangular figure with the basihyals, the three elements being of equal diameter at their point of origin. Each arm of the basi-



TEXT-FIG. 16. *Mabuya m. mabouya*. Hyoid of adult. $\times 4.5$.

hyals is 2 mm. long. From the anterior side of the tip of the basihyals spring the hypohyals, extending forward almost parallel to the glossohyal, with a slight angle part way, and 5.6 mm. over all. At this angle there may be a hint of the former division of these elements into two bones, but this is only suggested. From a slight node two-fifths from the base the ceratohyals arise, curving back and down, and ending in distinct epiphyals. The first and only pair of ceratobranchials spring directly from the truncate ends of the basihyals and continue their direction. No epibranchials are visible.

Food: No. 223 had eaten 2 hemipterons, 5 winged ants, 3 termites and a beetle.

Breeding: Skinks in breeding condition were taken in July and August. Female No. 2862 was captured on August 22, 1920. She was very stout as if she had eaten an enormous meal. Placed in a vivarium, seven days later she gave birth to four young lizards, averaging 93 mm. in length. Their coloration was less brilliant but otherwise much like the pattern and color of the adult. Two days after birth the quartet was scrambling all over the ground, constantly disturbing a pair of *Phylllobates* and another of *Dendrobates* in the cage.

The only specimen of this lizard taken at Caripito was captured in the laboratory. The head and body were 85 mm., with only 10 mm. left of the original tail. Its colors were brighter than those of any Kartabo specimens.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. *Ameiva ameiva*, adult male in final pattern, specimen 577. $\times .4$. Head and anterior half of body red-brown dotted with black, paler below; posterior half of body and tail bright green; belly pale blue.
- Fig. 2. *Ameiva ameiva*, dorsal view of full-grown specimens, one with double tail.
- Fig. 3. Head of *Ameiva*, showing irregular iris, $\times 2$. Top of head green, face pale lilac, pupil with broad orange ring.

PLATE II.

- Fig. 4. *Cnemidophorus lemniscatus*, adult male and female, lengths 285 and 160 mm. $\times .3$. Male with green head, limbs and under tail, yellow lateral spots; back brown and black. Female brown and black, showing a small extra tail.
- Fig. 5. *Iphisa elegans*, adult, specimen 553. $\times 4.5$. Brown above, salmon red below.
- Fig. 6. *Kentropyx calcaratus*, head of adult, showing irregular iris. $\times 4$. Sepia brown above, lilac below, iris scarlet.

PLATE III.

- Fig. 7. *Leposoma percarinatum*, adult, specimen 2965. $\times 4.5$. Sepia brown above with black bands, iris scarlet.
- Fig. 8. *Tupinambis nigropunctatus*, adult head, showing irregular iris. Nat. size. Anterior head brown, posterior spotted with yellow, neck wholly yellow.

PLATE IV.

- Fig. 9. Tegu's eggs in termite nest.
- Fig. 10. Tegu's eggs chopped out of termite nest. $\times .8$.
- Fig. 11. Full-grown embryo tegu in shell, and a tegu just hatched. $\times .7$.

PLATE V.

- Fig. 12. *Amphisbaena alba*, head of adult. Nat. size.
- Fig. 13. *Amphisbaena alba* in defensive position. Creamy white.
- Fig. 14. *Amphisbaena fuliginosa*, head of adult. $\times 2$.
- Fig. 15. *Amphisbaena fuliginosa*, dorsal view, and head of a second individual, showing asymmetry of pattern. $\times .3$. Black and white.
- Fig. 16. *Mabuya m. mabouya*, head of adult. Nat. size. Bronze above, lateral bands black with alternating bands of pink.

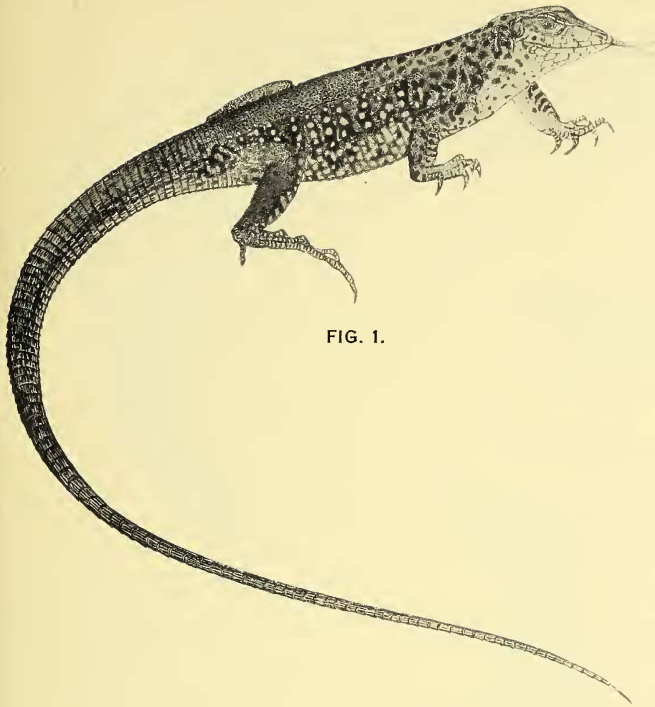


FIG. 1.

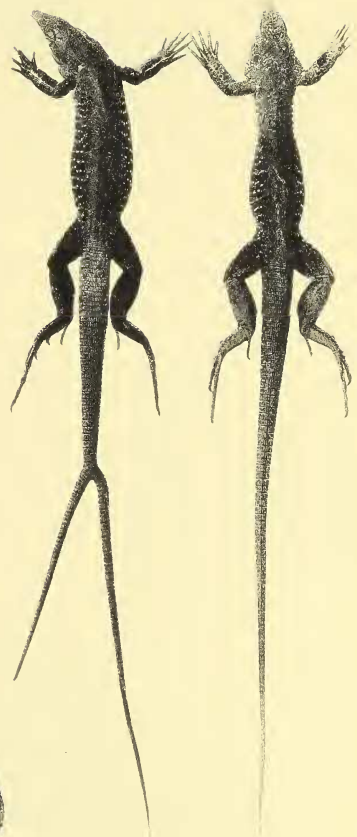


FIG. 2.

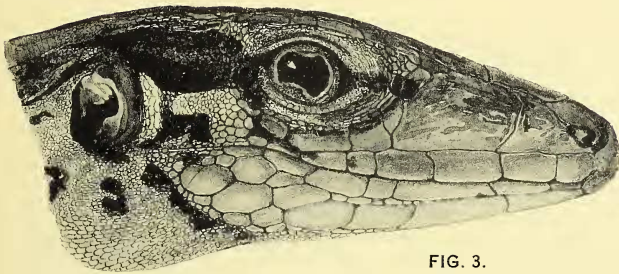


FIG. 3.

FIELD NOTES ON THE LIZARDS OF KARTABO, BRITISH GUIANA, AND CARIPITO, VENEZUELA.
PART #. TEIIDAE, AMPHISBAENIDAE AND SCINCIDAE.

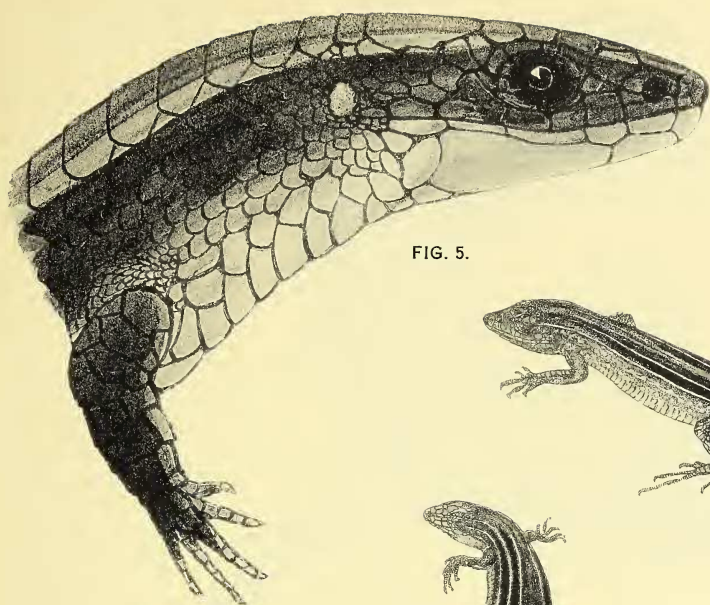


FIG. 5.

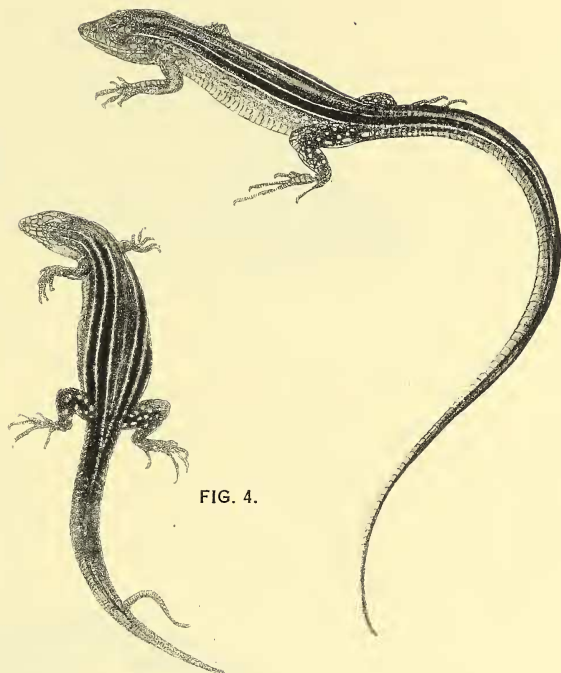


FIG. 4.

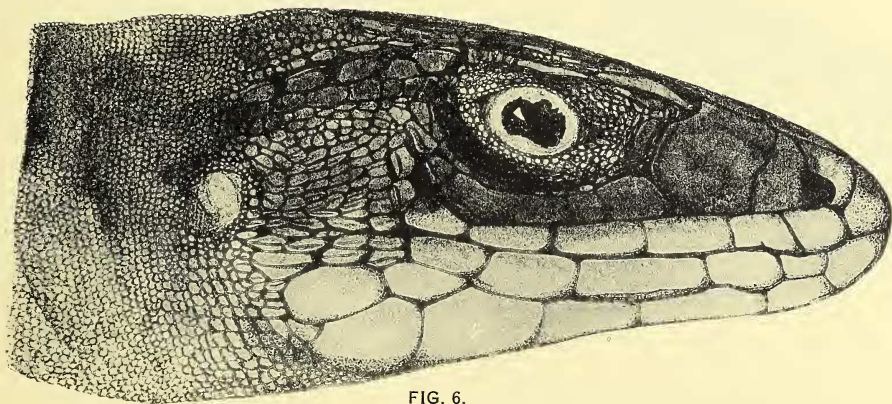


FIG. 6.

FIELD NOTES ON THE LIZARDS OF KARTABO, BRITISH GUIANA, AND CARIPITO, VENEZUELA.
PART #. TEIIDAE, AMPHISBAENIDAE AND SCINCIDAE.

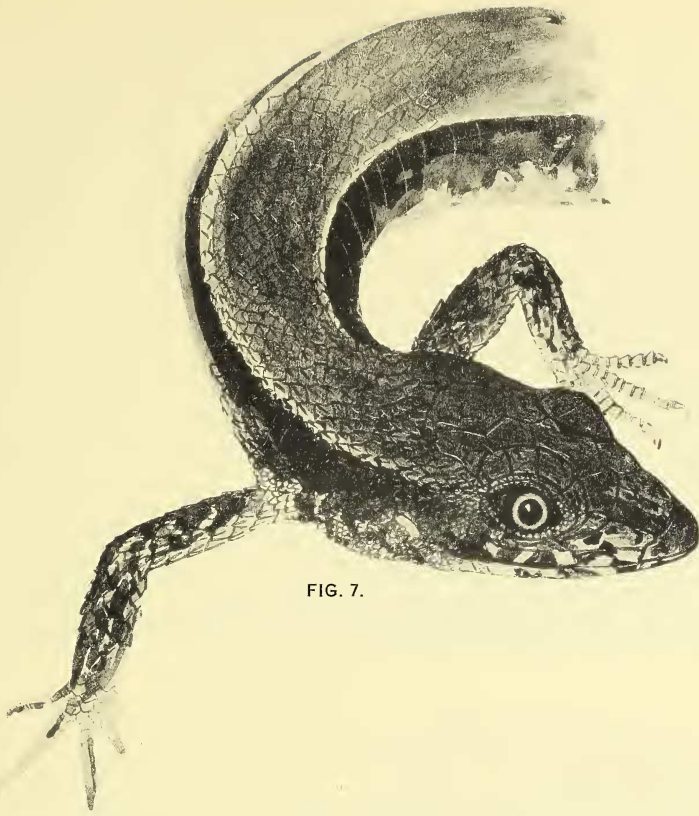


FIG. 7.

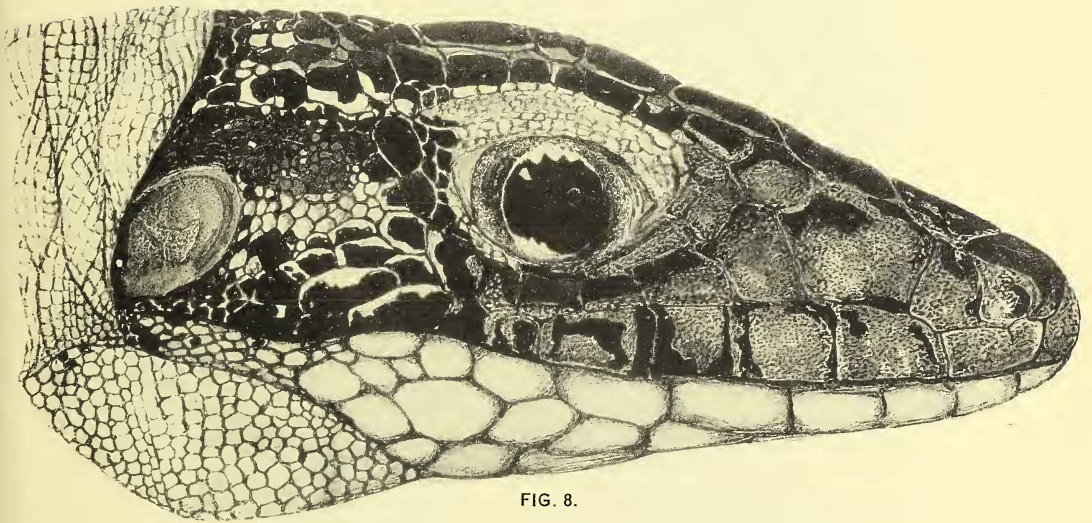


FIG. 8.

FIELD NOTES ON THE LIZARDS OF KARTABO, BRITISH GUIANA, AND CARIPITO, VENEZUELA.
PART #. TEIIDAE, AMPHISBAENIDAE AND SCINCIDAE.



FIG. 9.



FIG. 10.



FIG. 11.

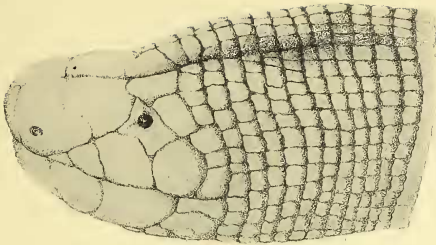


FIG. 12.

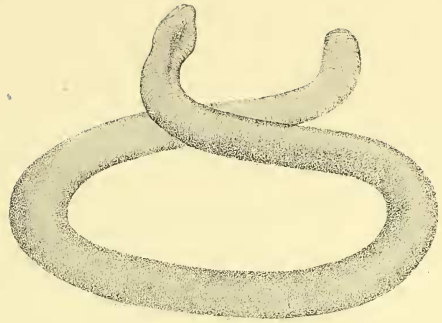


FIG. 13.



FIG. 15.



FIG. 14.

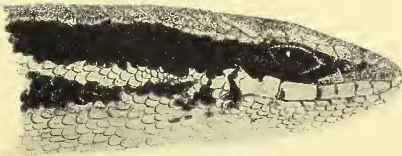


FIG. 16.

FIELD NOTES ON THE LIZARDS OF KARTABO, BRITISH GUIANA, AND CARIPITO, VENEZUELA.
PART #. TEIIDAE, AMPHISBAENIDAE AND SCINCIDAE.